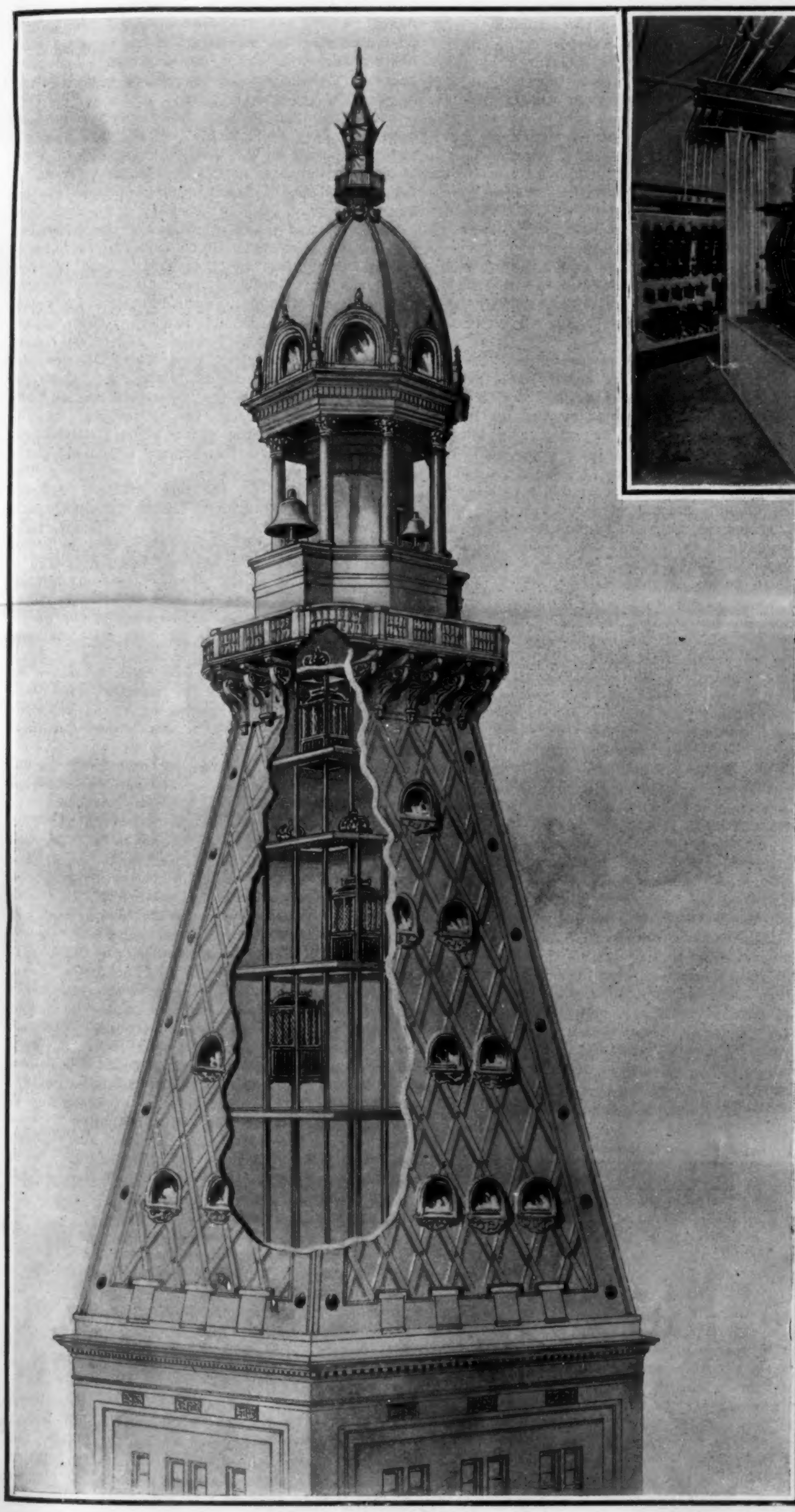
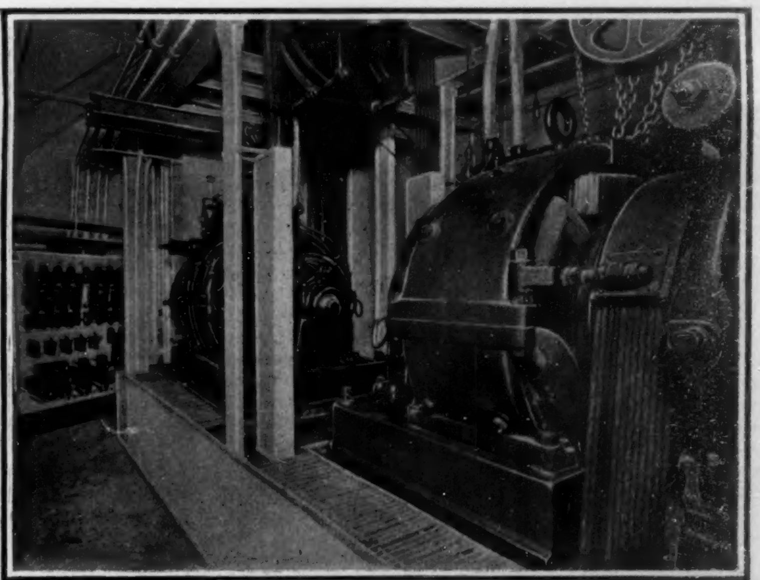
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.

A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CII.—No. 18. ESTABLISHED 1845.] NEW YORK, APRIL 30, 1910. [10 CENTS A COPY. $3.00 A YEAR.





The upper ends of the elevator shafts. **Motors installed at top of tower.** **Position of elevators in shafts.**

HOW THE PROBLEM OF INSTALLING THE ELEVATORS OF THE METROPOLITAN TOWER WAS SOLVED.—[See page 358.]

SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., Inc., - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York.
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York.

TERMS TO SUBSCRIBERS.

Subscription one year $3.00
Postage prepaid in United States and possessions
Mexico, Cuba and Panama.
Postage to Foreign countries .... $1.50 per year extra.
Canadian postage .... .75 per year extra.

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (established 1845) .... $3.00 a year
Scientific American Supplement (established 1876) .... 5.00 "
American Homes and Gardens .... 3.00 "

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., Inc., 361 Broadway, New York.

NEW YORK, SATURDAY, APRIL 30th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

WHY NOT A GOOD ROADS LABORATORY?

THE problem of maintaining good roads, always a most important one in the United States, has recently been rendered of critical urgency by the rapid development of the automobile—the most destructive vehicle to road surface that ever ran on our modern highways. The public resentment or regret, as the case may be, against the destructive effects of automobile traffic should be tempered by the recognition of the fact that it has been the most active instrument in awakening the public to the necessity for abandoning the old slipshod methods of road building, and constructing them according to the best engineering practice.

If it were possible to rebuild all our roads of the most approved and highest class of construction, and if the most suitable material were everywhere available, the problem would be greatly simplified, but such uniform excellence is impossible, both because of the cost and of the difficulty of finding the ideal materials within economical hauling distance of the work. In a country of such wide extent and such varied geological formation as the United States, the question of the best kind of roads to build in any locality must be determined largely by the local conditions—the climate, particularly as regards the amount and distribution of the rainfall; the nature of the underlying soil, its bearing quality, capacity for quick drainage, etc., and above all, the character of the materials available for road building, must all enter into the problem.

The French engineers, with their characteristic thoroughness, have long recognized the importance and complexity of the good roads problem, and nearly half a century ago they commenced that careful investigation which is still being carried on by a force of trained experts. The analytical study of the subject, which was set on foot by M. Buffet, Engineer of Roads and Bridges, as far back as 1868, has developed into the present municipal laboratory; which has so greatly extended its field of work, that to-day it is considered by many to be the finest in existence. At the date mentioned, apparatus was installed for testing the resistance of paving materials to wear by friction; which was followed by a machine for testing the resistance to abrasion of the stone used in Macadam roads. The laboratory also includes means for artificially producing those conditions and forces of a climatic character which tend to break up and destroy road surfaces.

Now here, it seems to us, is a plan which might very well be followed in this country by the founding of a national good roads laboratory, say at Washington, which might co-operate with similar but smaller institutions provided for and controlled by the various State legislatures. The cost of carrying on such institutions would represent but a moderate percentage of the money that is annually thrown away on the construction and so-called repair of highways by the present defective methods.

RATIONAL STREET LIGHTING.

THE proper lighting of a city is not so much a question of the total quantity of light provided as it is of its proper distribution. Because of the fact that America is the birthplace of modern electrical illumination, and the country in which it was first developed on an extensive scale, there is a popular impression that our municipal lighting is the best in the world, yet it is a truth that, because of the unscientific way in which we have distributed our lighting, the resultant illumination, judged by its adaptability to the needs of the user, is far less satisfactory than it might be, and, in its general results, is not as efficient as the lighting of European cities. This question was recently dealt with by Dr. Louis Bell in a paper read before the American Society of Municipal Improvements at its annual convention, and the principles which he laid down are at once so obviously sound and so frequently disregarded, that they are well worthy of careful study by the municipal authorities throughout the country.

The fundamental criticism against most attempts at street lighting lies, according to the author of the paper, not so much in the illuminants used as in their improper adjustment to the needs of the city. The fault particularly noticeable in American cities is the lack of careful discrimination between streets which demand considerable light and those which are perfectly illuminated with a less quantity of light. Most schemes of lighting aim at an approximation to uniformity of illumination over the whole area of the city, whereas, its quantity and character should rather be determined by the particular character of the streets in which it is placed. The main thoroughfares, in which there is considerable night traffic, should receive an amount of lighting commensurate with their importance, but in streets where traffic is light, and where passersby are few, it is sufficient to provide enough light to enable the people to get about comfortably. So also, a third class of streets, lying more remote and coming under the head of suburban roads, require yet another method of illumination. Since the fundamental purpose of lamps in the outlying, little-used streets, is to serve as markers of the way, the using of very large units, widely spaced, is obviously improper; a better way would be to employ small units located at shorter intervals.

The principal streets of American cities, according to Dr. Bell, as a rule are poorly lighted; the secondary streets are lighted sometimes better and sometimes worse than they should be; and the third class usually have one lamp in every long block, which is useless, except within a comparatively short radius, for such purposes as finding the number of a house or reading the address in a note book. As to the absolute amount of light required, the principle should be followed that in the principal streets, one should everywhere have enough light to read a paper by; which is the standard of illumination adopted in the principal streets of the large cities of England and continental Europe.

Much of the faulty street lighting in the United States is chargeable to the method commonly employed for measuring street illumination. The usual plan is to measure the light half way between the lamps with the photometer disk held normal to the ray; and, naturally, the tendency of competitors for the lighting contracts is to secure the specified minimum at as low a maximum as possible. Indeed, certain types of illuminants have been deliberately specialized for the purpose of giving two-hundredths or three-hundredths of a foot-candle at a distant point. Now, if these illuminants had been designed as they should have been, not to give a special form of illumination, but to give the best efficiency of which they were capable, it would be possible to make them light not only widely distant parts of the street, but the whole street. While it is not desirable to attain to uniformity with a low average of light, it is equally undesirable to concentrate the light at certain points separated by long stretches of comparative darkness. Summing up, the important points to bear in mind are, first, that streets are lighted for the people to use; second, that the streets should be lighted with reference to the particular use which is going to be made of them; and third, that, speaking generally, all the streets should be more brilliantly lighted than is customary in the United States to-day.

A BATTLESHIP FLEET IN EACH OCEAN.

FOR many years our Navy Department has followed the policy of concentrating an unusually large percentage of the total displacement of our ships in battleships of the first class. Every nation is following the same policy to-day, and has done so since the introduction of the first dreadnought in 1906. Many years before that date, however, the United States had practically ceased to build protected cruisers, and was concentrating its strength in vessels of the armored class, the majority of which were heavily-gunned battleships.

The advantage of this policy is seen in the fact that in a year or two's time it will be possible to maintain two complete battleship fleets, each of four divisions of four ships, one in the Atlantic and the other in the Pacific. Each of these fleets would possess a certain number of dreadnoughts, and would, therefore, be individually much more powerful than the one which made the recent cruise around the world. Although the department does not contemplate making such a division of our battleships' strength at that time, it is gratifying to realize that the steady growth of our navy has placed us in a position to thus safeguard each coast line if it were deemed advisable to do so.

The plan which is now under consideration is to make, within the near future, a complete reorganization of the Atlantic fleet. The details of the reorganization, which is evidently official, are published in the current issue of the Army and Navy Journal. It is proposed to place five ships in each division instead of four, so that all the ships may dock at their home yards twice a year, and one ship may be in her yard for repairs at any time, without taking from the usual strength of the division. The four divisions will be assigned to the yards at New York, Norfolk, Philadelphia and Boston, one division to each yard—a disposition which will enable the division commander to have his force at all times under his eye and immediately within reach. Practically no ship will be out of commission or in reserve, and when the vessels are in the yard for overhauling, they will have as nearly a full complement of men as possible, no battleship crew being allowed to go below 350 men—a force which would be sufficient to maintain the ship in condition to go into service at twenty-four hours' notice. The first division will dock at the New York yard, the second at Norfolk, the third at Boston, the fourth at Philadelphia, and the armored cruiser division at the Portsmouth yard.

If the present plans are followed the battleship fleet in the year 1911 will be made up as follows: First Division, flagship "Connecticut," and the five dreadnoughts: "Florida," "Utah," "Delaware," "North Dakota," and "Michigan." Second Division, the dreadnought "South Carolina," and the sister ships "Louisiana," "Kansas," "Vermont," and "New Hampshire" of the "Connecticut" class. Third Division, the four sister ships: "Georgia," "Nebraska," "New Jersey," and "Virginia," of the "Georgia" class, and the "Ohio." Fourth Division, the "Minnesota" of the "Connecticut" class, the sister ships "Mississippi" and "Idaho" (smaller "Connecticuts"), and the sister ships "Maine" and "Missouri." There will be a fifth division consisting of the four armored cruisers "Tennessee," "Washington," "North Carolina," and "Montana." In the year 1912 we shall have sufficient battleships to provide for a fleet in active service, consisting of twenty-one battleships and a Reserve Fleet of eleven of the older battleships. The first division of the active fleet will consist of six dreadnoughts; the second division, of two dreadnoughts and three "Connecticuts"; the third division, of three "Connecticuts" and the two smaller "Connecticuts," "Idaho" and "Mississippi," and the fourth division, of the five vessels of the "Georgia" class. The fifth division (armored cruisers) would consist of the four ships of the "Tennessee" and "North Carolina" class.

Our readers will recognize at once that in the above organization, ships of the same general type have been assembled in the same division. The largest vessels will dock at the New York and Norfolk yards, where the largest drydocks and the best facilities are to be found. The commander-in-chief and the auxiliary vessels of the fleet will make their home at the New York yard, since that is the most central point for the purpose. The reserve fleet will be kept at Philadelphia; and the most effective destroyers and torpedo boats will be maintained in commission at New York, Boston, and Norfolk.

By the year 1912, then, the United States navy will contain thirty-one battleships, made up of four divisions, with four ships in each division always ready for sea service and one at the yards for overhauling and refitting; and each division commander will have all the ships of his division within immediate reach throughout the whole of the year. At the same time, should the political situation be such as to render this desirable, as we have noted above, it will be possible to divide this force into two fleets, one for each ocean, each fleet being of considerably greater fighting strength than the one that made the memorable cruise around the world.

W. R. Ham finds by direct observation on the primary Roentgen rays that a polorization exists and is independent of the position of the normal to the target. The max. intensity is, within experimental error, in the plane through the target normal to the kathode-ray stream, and the intensity falls off symmetrically on either side of this plane. The interposition of sheets of silver and tin causes an increase in polarization which reaches the same upper limit for both metals. Lead decreases the polarization, but no lower limit was observed. Aluminum, paper, and glass cause very slight change, if any, in the polarization. All the observed results are completely explained if it be assumed that the ordinary Roentgen-ray beam consists of a mixture of primary and secondary rays originating in the target, and that the secondary rays are completely unpolarized.

ENGINEERING.

That fine old cup defender, "Volunteer," which was bought by Capt. Barr last year, has been sold to a firm of wreckers, who will break her up for the value of the lead and fittings. She was the craft that proved so thoroughly the master of the Watson cutter "Thistle" in 1887. "Thistle," by the way, under her present name of "Comet," is still in good shape, and is still being used, we believe, as a training ship in the German navy.

The three engineers appointed by the Canadian government to consider the application of the St. Lawrence Power Company for permission to dam the Long Sault Rapids at Cornwall, Ontario, report that the enterprise is worthy of most serious consideration. They urge that, before the government approval is given, there should be a complete agreement between Canada and the United States as to the supervision and control of plants on both the Canadian and New York State banks of the river.

It is officially stated that all the excavation that was contemplated in the original project of the Panama Canal has now been completed. The original plans of the canal called for the removal of 103,795,000 cubic yards of material; and a few weeks ago the total excavation done to date under American occupancy had reached that amount. The 71,000,000 cubic yards remaining to be excavated represent the additional work necessitated by the enlargement of the canal, which was decided upon during the Roosevelt administration.

The Canadian government is giving consideration to a project for a freight traffic railway to Hudson Bay, surveys for which are now being made. An unusual feature is that the new road would have to be operated to its full capacity for about two months of the year, during the moving of the grain crop, and that for the other ten months there would be scarcely sufficient traffic to warrant operation. It is estimated that sixteen trains per day could be handled over the single-track line, and sixty-four million bushels of wheat could be delivered in thirty days' time.

The battleship "Indiana" has undergone some tests of the "ship brake" with which she has been equipped. This device consists of a pair of steel wings, hinged to the vessel's side and normally held against the ship, which, when a quick stop is to be made, as in the case of impending collision, are released through mechanism controlled from the bridge. They swing open automatically through the forward motion of the ship, and it was found that the vessel could be brought to a stop within the distance of her own length without injurious shock or strain.

The "Neptune," the latest of the British dreadnoughts, will have, it is stated, the same length over all, 560 feet, as our own "Wyoming;" but her beam will be several feet less than that of the American vessel. She will carry ten 50-caliber 12-inch guns in five turrets, the two turrets amidship being placed diagonally, so as to enable all ten guns to be fired on either broadside. Her concentration of fire from her 12-inch guns will be six ahead, eight astern, and ten on the broadside, as compared with the "Wyoming's" fire of four ahead, four astern, and twelve on the broadside.

The United States Steel Corporation, which recently made a general increase in wages, has decided to put in force a system of pensions and disability payments for the wives and children of those killed in its employ, and of disability payments for the injured. The corporation will also shortly put in force a pension system for superannuated and disabled employes. This movement is to be most highly commended. In its humanitarian aspect, it will be a great boon to the employes; and its wisdom as a means of promoting loyalty and checking the growth of anarchistic sentiment is unquestioned.

Construction work will shortly commence on another of those stupendous buildings which are rapidly earning for New York the right to be called a city of towers. The new structure, which is to be built at the northwest corner of Wall and Nassau Streets, on a ground plan measuring 94 by 97 feet, will extend 539 feet above the street level; an elevation which will make it the third tallest office building in the world, the Metropolitan tower being 700 feet high, and the Singer tower 612 feet. The tower will be finished with a pyramidal cap 94 feet in height, which will be utilized for holding the water tanks.

The Great Central Railway of England recently performed the feat of transporting a 77-ton casting upon a 50-ton car. This was done by coupling a flat car on each end of the carrying car, and mounting upon each of the flat cars a massive, trussed, oaken girder. The inner ends of these girders extended above the ends of the 50-ton loaded car, to which they were attached by chains. The girders were pivoted at the center of the two flat cars, and their outer ends were loaded with about 9½ tons of dead weight. This arrangement served to transfer 19 tons of the load from the carrying car to the flat cars, thus bringing the actual load carried below the 50-ton capacity of the car.

ELECTRICITY.

At a recent meeting of the Electrical Club of Chicago, it was brought out that there are three thousand storage battery automobiles in Chicago. There are thirty-three storage battery installations in the city with an output of 47,000 kilowatts, while in New York city the total output is 57,000 kilowatts.

An old barge has been equipped with electric welding apparatus at Gothenburg, Sweden, to be used in repairing the boilers of steamers. The equipment consists of a De Laval turbine and two direct-current generators. The current is conducted to the steamer requiring repairs by means of a pair of cables, and work can thus be done within the boilers with power generated on the barge. The barge is also fitted with a workshop where small repairs may be made.

An enterprising newspaper in South America is about to install a wireless telegraph system at its main office. This will be the first wireless newspaper office on the continent. The paper we refer to is La Prensa, of Buenos Ayres. The Argentine Republic is going to celebrate its hundredth anniversary with an exposition this year, which opens on May 25th, and La Prensa expects to keep in "wireless" touch with the exposition grounds.

A French inventor, M. Paul Jegou, has devised an electrolytic detector which operates without the use of a battery to affect telephone receivers. The detector consists of a glass cup containing at the bottom a small amount of mercury with some pure tin in solution. This serves as one electrode, while the other electrode is of the usual type, namely, a fine Wollaston wire. Dilute sulphuric acid is used for the electrolyte. The detector is found to act like a small battery, and yet possesses all of the sensitiveness of the electrolytic detector. One of these detectors used at Paris was found to receive signals sent from the Ouessant post on the coast.

Considerable attention has been directed of late to the effect of sunlight on the transmission of Hertzian waves. A writer in Electrotechnische Zeitschrift, in commenting on this subject, points out that the stronger the sunshine the less the conductivity of ether to the Hertzian waves, so that it is incorrect to speak of a wireless telegraph station as having any definite range; for one which has a large radius of communication in northern latitudes would have a much smaller radius in the tropics. This would be particularly noticeable on vessels sailing north and south, and he suggests that it would be desirable to prepare a "radio-topographical" map, giving the relative conductivity of the ether at different latitudes.

A comparison of the inclosed arc and the intensified arc for indoor lighting was recently presented before the Minnesota Electrical Association convention. It was shown that because of the large carbons used in the inclosed arc, the carbons being half an inch in diameter, the arc is apt to wander along the edge of the electrode, so that instead of giving a uniform distribution of light, the light is greater on one side of the lamp than on the other. With the intensified arc lamp, there is no wandering of the arc. The electrodes are much smaller, consisting of two upper electrodes a quarter of an inch in diameter, and a lower one three-eighths of an inch in diameter. If the same amount of current is passed through this lamp as through the inclosed arc lamp, the electrodes will be heated to a higher incandescence, thus giving a greater and steadier light.

The Board of Underwriters of Chicago has issued the following requirements for wireless telegraph installations: Aerial conductor must be at least No. 8 B. and S. gage rubber-covered wire run on petticoat insulators on exterior of building and on knobs, cleats or in molding in interior of building. Porcelain bushings to be used through walls, partitions and floors. Aerial conductor must be permanently and effectively grounded at all times when station is not in operation by a conductor not smaller than No. 4 B. and S. gage rubber-covered copper wire run as nearly in a straight line as possible to a water pipe at a point on the street side of all connections of said water pipe within the premises, or to some other equally satisfactory artificial earth connection, such as an iron rod or pipe driven at least 5 feet into the earth. Ground wire should be protected from mechanical injury by inclosing it in molding at least 7 feet from the ground on exterior of building. The switch employed to join the aerial to the ground connection must be an approved 100-amp, single-pole, double-throw knife switch placed as nearly as possible to where aerial enters and must effectively cut off all apparatus within the building. Aerial conductor may be permanently connected at all times to earth through an approved lightning arrester placed as nearly as possible to the point where the wire enters the building and grounded as specified above. Ground wires for lightning arresters must not be attached to gas or steam pipes within the building, nor be run inside of iron pipes.

SCIENCE.

In a recent number of the Astronom. Nachr., C. Ceraski calls attention to a new variable star or nova, found on a plate taken March 23rd, 1909, at 10h. 6m. to 12h. 6m. (Moscow mean time). The image was found in a position that was vacant on 24 previous plates, showing stars down to 12.5 magnitude. The star's approximate position is a = 8h. 29m. 26s.; $\delta = + 53$ deg. 50 min. (1900).

G. A. Campbell recently conducted some experiments to investigate the subject of telephone intelligibility. In his experiments, usually only detached syllables were employed, so as to give the listener no clue from the context. The syllables easy to interchange are right in about half the cases. Thus, while it is obvious that the telephone seriously distorts speech waves, nevertheless, even those consonants which nearly resemble each other are not sufficiently distorted to be indistinguishable.

A good photometric measurement of the brightness of the nucleus of Halley's comet was obtained on April 21st by Prof. Wendell at the Harvard College Observatory. The measured magnitude of the nucleus was 6.4. The total brightness of both the nucleus and the surrounding coma was a little above the fifth magnitude. With the approach of the moon toward the region in the sky in which the comet is found, there will be very little to repay the early riser. In fact, astronomers do not look for any spectacular display while the comet is in the eastern sky.

From a study of the radio-activity at the earth's surface, made by G. A. Cline, it would seem that the soil contributes by far the greater proportion of the penetrating radiation present at the earth's surface at Toronto, and by comparison any that may have its source in the atmosphere or in the sun may be considered to be negligible in amount. There are no regular diurnal maxima or minima, but there are changes from day to day which seem connected with concurrent barometric changes. The conductivity is greater when the ground is bare and warm than when it is frozen and covered with snow. Filtering air through cotton-wool still leaves many suspension particles.

A letter has been received from Prof. E. B. Frost, director of the Yerkes Observatory, at Harvard College Observatory, in which Prof. Frost records recent observations of Halley's comet. He found the comet more conspicuous than the adjacent star Pascium, and Prof. Barnard estimated the nucleus, which was not stellar, to be two magnitudes fainter than this star. On April 14th the comet was photographed with six minutes exposure. No tail was visible with any of the instruments. Visual observations of the spectrum were made by Prof. Frost and Dr. Slocum, and showed a distinct continuous spectrum from the nucleus. No bright bands or lines were seen. The intensity of the continuous spectrum, relative to the emission bands, has greatly changed since the comet was visible in the evening.

Some idea of the enormous amount of labor required to extract radio-active substances from their ores may be gained when it is considered that to obtain two milligrammes of substance containng 0.1 milligramme of polonium, it was necessary for Madame Curie and A. Debierne to treat several tons of uranium. Fairly pure helium was isolated from the gases given off by a solution of polonium under a high vacuum in a quartz tube, due to the action of the alpha-rays emitted by this element. The life of radium is about 5,300 times that of polonium (which is reduced to one-half in 140 days). The spectrum is being studied with a view to ascertaining if an inactive element is derived from it, polonium, according to theory, being the last radio-active term in the series of derivatives from radium. The atomic weight was estimated to be about 200.

A new preparation has appeared which cleans and polishes silver, silver plate, nickel, and other white metals, and which is said to produce a plating on pure silver and any metal except gold by mere contact of the preparation with the metal. In view of the publicity given lately in British scientific journals to a similar preparation invented by Rosenberger, it is interesting to note that the American article has been known in the United States for several years, although offered more prominently only since 1908. Rosenberger's preparation requires a different modification for each metal. The American preparation is a white, creamy liquid, perfectly stable and unaffected by light, and is claimed to be perfectly free from mercury, acids, and other injurious ingredients. So far as we are able to determine, its plating action seems to be due to the affinity which the metal to be plated exerts upon the molecules of silver in the solution, so that the resultant plating is identical with that produced by ordinary dynamic electroplating. No electric current is necessary to produce the plating, nor is an addition or admixture of any other substance required.

A RAILWAY SCHOOL FOR FARMERS

BY H. A. CRAFTS

Demonstration train at a way station in California.

In response to an urgent request from leading dairy interests in Southern California, Prof. Leroy Anderson, head of the dairy department of the California College of Agriculture, has just made an examination of the milk conditions in that part of the State.

Prof. Anderson says that in consultation with the dairymen, it was decided to inaugurate a general policy of education upon the subject. In his opinion, the reform of many conditions now undesirable in the methods of producing milk, can better be reached through the commercial aspect of the business and through the education of the producer and the consumer than through drastic and radical legislation.

He says that he finds the conditions under which milk is produced about Los Angeles are not materially different from conditions in other populous centers, except that nature is possibly kinder in granting more sunshine and less rain and a more porous soil, all of which tend toward an easier cleanliness.

What advice he has to offer, therefore, is applicable to all parts of California. He hopes especially that the man who is producing and selling directly to consumers in the smaller towns and cities, whether he has one cow or more, may receive an incentive to have better cows and keep them in a clean and a healthy condition.

In cities like Los Angeles and San Francisco, he says, where large wholesalers act as distributing agencies between the producer and the consumer and pasteurize all the milk, some of the dangers that might result from disease of the cow and uncleanliness are obviated.

"It does not have a pretty sound," continues the professor, "to say that lack of care on the part of the producers is partly the reason for the expensive pasteurization which the wholesalers now give to milk."

"Pasteurization, however, is one of the advance steps toward a healthier race, and some day this process will give way to such clean methods of producing milk that it will not be necessary. That is the goal toward which we are all striving."

"It costs money to produce clean milk, which cost must be met by a higher selling price or by more profitable cows, or both. The cow is especially in our mind just now, and we call the reader's attention to records taken from different sources to show by actual figures how cows vary in returns to their owners from similar outlay for food and care."

Prof. Anderson then refers to the subject of proper stables and corrals for dairy cows, and says:

"The great thing to be desired in either, is that there should be easy means of keeping clean and then keep them clean. This is the chief reason for using concrete in stable floors. It does not decay and then cause foul odors, and it can be hosed down with water and swept in a few moments, so that no dirt remains. Some dairymen object to cows standing on concrete, but in California, where the cows are in only for feeding and milking, they suffer no injury.

"Occasionally a very good stable is constructed where the cattle stand, which portion is made of plank. This works well from a sanitary point, if the planks are water-tight or are underlaid with a water-tight substance so that the soil under the planks cannot become saturated.

"A milking stable is absolutely essential to the production of clean milk. Milking in the corral is an abomination, either in winter or in summer. In winter, during the rainy season, it is not uncommon to see both cow and milker wading nearly to the knees in mud, when of necessity the milk must become the depository for some of the mud.

"In summer, when the corral dust may be from one to four inches deep, the condition is even worse. The dust is raised with any slight breeze or with every movement of man or beast, and even more dirt finds its way into the milk than during the time of rain and mud. Thus the cows must be provided with some stable which is dry and clean, and where they can be held for milking.

"The stable needs not be expensive. On the contrary, it may be very simple, and the less lumber in it the better, so long as the frame is sufficiently strong. It should permit the entrance of an abundance of direct sunlight and have enough openings to give constant ventilation. Large louvers in the roof are excellent for ventilation and also admit light, but not direct sunrays."

Salol Liniment for Burns.—Salol, 10 parts; olive oil, 60 parts; lime water, 60 parts.

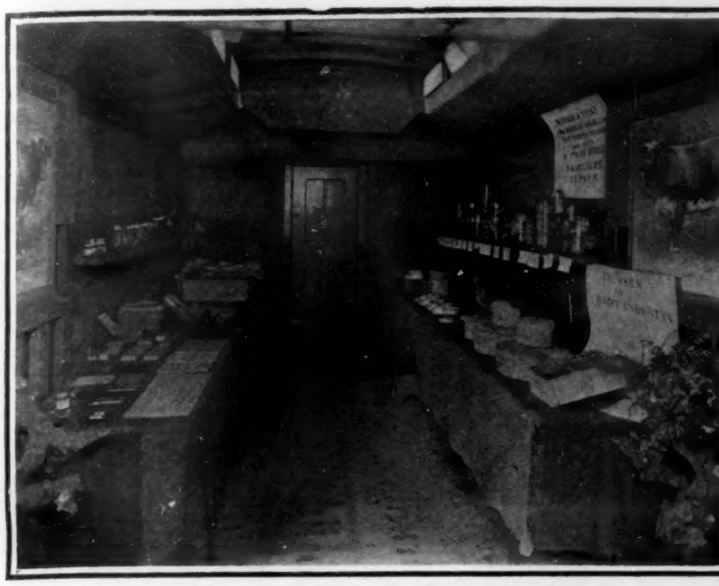
Lecture in agricultural and horticultural demonstration train.

A RAILWAY SCHOOL FOR FARMERS.

Bread Under the Microscope.

Bread, like milk, is one of the most general articles of food, and as such is subjected to the most frequent adulteration, and unfortunately it happens that such a fraud cannot always be detected with ease. The experts who have given especial attention to this kind of adulteration agree in the statement that under the influence of the preparation of bread the grains of flour undergo certain changes in their outer appearance that render them much less distinguishable. In a most praiseworthy article recently published in Les Annales de la Chimie Analytique, Eugène Collin recounts the results of his tireless examination of pure bread and adulterated bread. In the course of his laudable endeavor, it seems, he found himself able to determine with passable exactness the quantity of pure flour in baked bread, whether the bread subjected to microscopical examination was old and hard or fresh. His procedure was to soften a crumb of bread with as little water as possible and knead it persistently with forefinger and thumb over a fine sieve resting on a vessel that should receive the dripping water. The mass is treated in this manner until the water ceases to look darkened. A powdery mass then remains on the sieve, which is deposited on the crystal of a watch, combined with a trifle of glycerine, and is then set aside for further examination. Besides, to the water in the vessel is given an opportunity to clear itself, and it is then decanted so carefully that the sediment is not disturbed. The result of such treatment is that from the deposit on the sieve and that in the vessel the true composition of the bread can be ascertained.

Bread made from pure flour leaves only an imperceptible quantity of starch on the sieve. On the other hand the greater part of the gluten is found on it and forms a net of irregular meshes and shows some resemblance to vegetable tissue. In consequence of the ease with which its presence in the bread is ascertained, the gluten is especially important for microscopical examination. In the same deposit the microscope showed numerous particles of starch which during the preparation of the bread changed their ordinary form or were forced to explosion. Still there is a rather considerable number of them that have escaped this influence and are easily recognized from their size, color, form, and the presence of the navel. These statements regard wheat bread only. The result when rye bread passes under the same procedure is that the deposit on the sieve consists of gluten only, and therefore proportions in a mixture of both kinds of flour can be ascertained with a large degree of exactness under the microscope. Particularly, however, is this done through a test of the precipitate of flour, since the grains of starch of wheat and of rye are distinguished from one another by the shape of the navel, that is, the former point of connection of the



Dairy exhibit, agricultural demonstration train.

Cereal exhibit, agricultural demonstration train.

A RAILWAY SCHOOL FOR FARMERS.

placenta. The most resemblance to these is shown by the grains of barley, the addition of which is ascertained with a satisfactory degree of certainty from the precipitate on the sieve. A quite customary adulteration of bread is effected with rice flour, which always fails to escape the scrutiny of the microscope when this is invoked, for the grains of starch of rice are always left in great number on the sieve and are more easily recognized because during the preparation of bread they suffer less change. This result of M. Collin's investigation is extraordinarily important, for the addition of rice flour to wheat flour or to rye flour has begun to be a veritable torment. Besides, certain kinds of corn meal have been misused in the same way, though easily detected by the microscope.

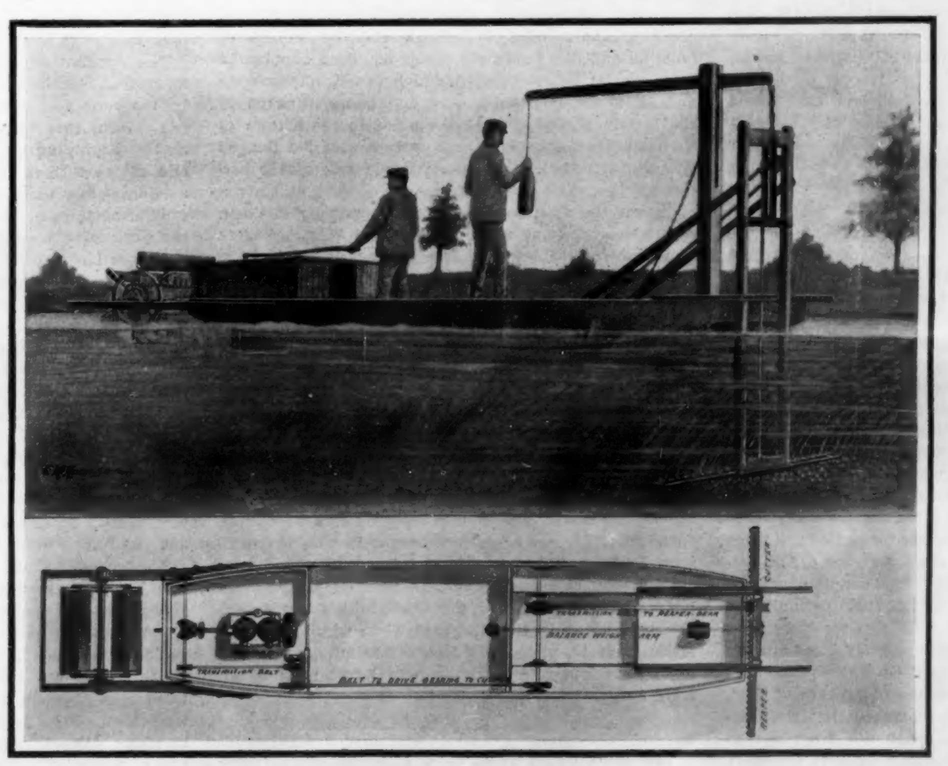
A REAPER BOAT

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN

A French constructor, A. Amiot, has brought out a type of boat combined with a set of cutting blades, which is designed for use in cutting off aquatic growths in ponds or artificial lakes, mill races and various water courses. Such operations are often necessary where the bottom of a pond or water course becomes obstructed by the thick growth of aquatic plants, but where it is required to be carried out by hand labor it becomes a difficult and also an expensive matter, especially where a large area has to be dealt with. M. Amiot's device overcomes the difficulty by using an internal combustion motor mounted on a boat, and the motor serves to drive a set of cutting blades, which are designed somewhat after the fashion of reaper blades and adapted in their form so as to carry out the cutting of the plants under water in the best manner. The boat is rather narrow, and flat-bottomed, being much narrowed at the front and the rear. In the front is carried a paddle wheel, which is run by a gasoline motor, which drives the boat at a slow speed. Its total length is about 20 feet.

The cutting bars are mounted at the lower end of a vertical frame, which is held at the rear end of the boat, and these extend transversely across the bottom of the frame so as to lie at a point near the bottom of the water course or pond and to cut off the plants as the boat advances. Such bars are made in different lengths and also at different curvatures so as to be adapted for flat bottoms or for beds of streams of different forms and sizes. The bars are usually from 6 to 12 feet in length, and are designed to cut off a considerable area at a time. This gives the present system a great advantage in being able to cover a large surface within a short time and at a comparatively small cost. As will be observed in our engraving, the frame, which is made up of two vertical angle irons braced in the proper way, is suspended at the end of the boat, and it hangs in a free position, being swung upon the end of the lever, which is observed at the upper part, and this lever is pivoted in an upright. By means of the counterweight at the end of the lever, the entire frame can be raised and lowered, and this gives the adjustment of the cutting bars at any desired height in a convenient way. The gasoline motor is placed at the other end of the boat, and there is a belt transmission running to the rear end, which operates the pulley placed in the upper part of the cutting bar frame. This does not interfere with the raising or lowering of the frame, as will be noticed, seeing that the belting and pulleys can work at different angles. On the shaft of the pulley is a crank which drives a rod, and this last passes down along the frame to the lower part, where it connects with a rack and pinion movement. By means of the alternate up and down movement of the rod, and the rack and pinion at the lower part, the cutting blades are given the to and fro movement in the same way as is seen in the usual blades, and in this way a wide swath is cut under water, and at any desired height above the bottom. The paddle wheel is carried on a frame which is adjustable by means of bolts, so as to give the paddles any desired immersion, and the gasoline motor drives the wheel by gearing and chain device, using two separate countershafts for this purpose so as to give the needed speed reduction. The gasoline motor is operated at the standard speed of 500 revolutions per minute. When it is required to take the boat into shallow water or otherwise to pass over rocks or other obstacles, the cutting frame can be lifted entirely out of the water. In this case the cutting bars are folded up along each side of the frame so as to occupy but little space. In usual practice the cutting is carried out at the rate of 1½ miles an hour, and the cost of operating is estimated at $0.35 per mile, comprising gasoline, oil, labor, together with depreciation and maintenance. For cutting one acre area, the cost is figured at $2.70.

The Amiot system is meeting with great success in Europe, and it is now in use on the artificial lakes of the domain of the Institute of France, at Chantilly, and also on the domain of Laeken, belonging to the King of Belgium. It is also used on a number of canals and rivers in France.



The upper view shows reaper boat in operation. The lower picture is a plan view showing transmission gearing.

A REAPER BOAT.

According to the Electrical Review and Western Electrician, the Park Building at Pittsburg, Pa., which is 15 stories high and contains 400 offices, was recently lighted by carbon-filament lamps and had its interior decorations painted a deep sea-green color. It is now lighted by tungsten lamps, and has its interior painted a light buff color. On replacing 3,910 carbon lamps (56-watt) by 780 100-watt and 200 25-watt tungsten lamps, and 21,840 watts in 16 and 32 candle-power carbon lamps in the corridors and lifts by 8,400 watts in 40-watt and other tungsten lamps, 149.4 kilowatts is saved.

THE ELEVATOR INSTALLATION OF THE METROPOLITAN LIFE TOWER.

BY HERBERT T. WADE.

In the newly-completed Metropolitan Life Insurance tower is to be found an example of an installation which serves the purpose of lifting cars to an altitude greater than that attained in any building yet constructed. Judged independently of its height, the installation is a model of modern elevator engineering. Furthermore, it is significant of the successful development of a comparatively recent type of elevator machine which has been tested in actual use and found to answer the requirements of service as well as the requirements of mere height. Great as the lift is, the designers claim that it is possible to go even higher and that elevators can be installed in any skyscraper which the ambitious architect may yet essay. As a result of this engineering achievement there is no difficulty in renting offices far above the city's noise and dust. No more time is consumed in reaching the 44th story of the Metropolitan tower than the 12th floor of older buildings.

For the Metropolitan Life tower, the type of elevator selected was the Otis traction overhead machine, in which the motor and driving sheaves are situated directly above the hatchway. High up in the apex of this white marble campanile are to be found powerful electric motors, whose installation at this elevation taxed the ingenuity of the architect and engineer. They are without doubt the highest motors working in any building.

The problem of high rise in a tower building is one that can be solved by but few types of elevators. A height of 400 feet marks the limits of the plunger and other hydraulic machines. In many forms of electrical elevators the weight of heavy moving cables or other parts, and the exact regulation of the car or load, are difficult if not impossible of attainment when certain heights are exceeded. In the Otis system illustrated we have a simple machine that has been found to work with ease, safety, and reliability. A motor is mounted at the top of a shaft or hoistway. The armature shaft carries between its two bearings a driving sheave, around which the six cables suspending the car are passed. One end of the cables extends to the car; the other to the counterweight, which moves up and down in guide rails at the side of the shaft, and is equivalent to the weight of the car and its average load. Directly below the driving sheave is fitted an idler sheave, around which the supporting cables are laid, so that it passes again around the driving sheave with which it is in contact for two half-turns. When the current flows through the motor, the armature rotates and moves the car up or down as desired. When the current is cut off, powerful automatic shoe brakes are applied to hold the driving sheave. A compensating cable, in older installations a chain, is connected with the bottom of the car, extends to the bottom of the shaft, passes around sheaves or pulleys, and then extends to the counterweight. Its object is to compensate for the weight of the supporting cables, whether the car is at the top or the bottom of the shaft. In other words, the system is very nearly in equilibrium; and the function of the motor is merely to move it with such additional load as is supplied by the passengers in the cars. When the Metropolitan installation was considered by a board of elevator engineers, it was realized that this system was the only one that would meet the conditions demanded in an office building of extreme height. The thorough tests which the machines have received since their completion has justified the engineers in their selection.

The Tower installation, which is quite independent of the elevator systems serving other parts of the huge Metropolitan Building, consists of six express elevators, which make no stops between the street and the 10th floor. The cars are arranged in the center of the tower in two banks or rows of three each, five of the six running from the 1st to the 41st floor, or a rise of 524 feet 11½ inches. The middle car on the east bank runs from the basement to the 41st floor, while the middle car in the west bank runs from the basement to the highest landing in the tower on the 44th floor, a distance of 586 feet 5½ inches. With a live load of 2,500 pounds, or about 16 passengers, the cars can make a speed of 600 feet per minute without stops, which is the maximum permitted by the present New York Building Department regulations. Thus the journey to the top floor consumes but a few seconds under a minute, which is recognized as about the limit demanded by office building renting conditions. The actual consumption of time by the passenger does not place the tower building at any disadvantage over lower buildings, where slower speeds and frequent stops may require the same expenditure of time. In this connection it may be remarked that the traction machine illustrated can accelerate from a stop to full speed in from two to three seconds smoothly and evenly, so that the passenger experiences no unpleasant sensation.

Each elevator is expected to travel up and down daily a total distance of 20 to 25 miles. The interest of the engineer naturally centers in the motors, which have been installed at the top of the tower under most extraordinary conditions; for as the view of the tower shows, the tapering top affords little space for heavy machinery.

Elevator installation was not a final feature of the construction of the tower, but an ever-present condition. As fast as the structural workers completed the framework, the rails for the cars were set in place, and a temporary elevator was rigged to send up the materials of construction. As the material for the five machines for the elevators running to the 41st floor could be carried up by the high-rise elevator, their erection was not so difficult a matter. When it became necessary to raise the machine for elevator No. 2 up to the 45th story, a serious problem was presented. Eventually, the task was accomplished, and the huge castings and armature were sent up to a point where they could be set in place by an ordinary tackle. These machines weigh 21,000 pounds each in the case of four, and 23,000 pounds each for two elevators where devices are employed to enable extra heavy loads, such as safes, to be raised. The magnet controllers weigh 2,000 and 2,200 pounds respectively for the two classes of machines. It is here that the operation of the switches governing the motors centers, which switches are under the control of the car operator.

The motors are rated at 40 horse-power and use 115 volts direct current. They run at a speed of from 35 to 58 revolutions per minute, and the peripheral velocity of the driving sheave on the armature shaft gives the speed of the car. The limited space in a high tower presents problems quite different from those of a large building, such as that of the Hudson Terminal, where the traction machines can be arranged in orderly rank. In the tower one machine may have to be placed above the other, or at an angle perhaps, while the controllers and other auxiliaries must be fitted in wherever a place offers. Consequently, the machinery room of the tower has a bewildering appearance. Every inch of space is utilized. Despite crowded quarters, there is the utmost order.

Around the driving sheaves pass the lifting and counterweight cables, six in number for each machine. They are ⅝ of an inch in diameter, and each cable has a breaking strength of 20,000 pounds. The length of the several cables for the various cars varies from 575 to 626 feet for the high-rise car. Another important cable is that passing through the car to the centrifugal speed governor at the top of the hatchway. These are ½-inch cables, and they vary in length from 1,144 to 1,274 feet. Their function is to transmit the motion of the car to the centrifugal governor, which in case of excess speed not only cuts off the power, but causes the safety device of the car to come into play and lock it firmly to the rails. The cars, which vary from 5 feet 4 inches by 6 feet 4 inches to 5 feet 4 inches by 8 feet, weigh about 4,000 to 4,500 pounds each. The counterweight is slightly heavier than the empty car, so that the car is assumed to carry an average load.

In the more recent Otis traction elevators, the clanking chain used to compensate the weight of hoisting and counterweight cables has been supplanted by a special flat wire rope, which is 3¾ inches wide and ¼ of an inch thick, one end being attached to the bottom of the car and the other to the bottom of the counterweight. This cable passes over flat flanged sheaves, arranged in a channel-iron frame at the bottom of the shaft, which frame is carried in such a way that the sheaves are free to move up and down as the hoisting ropes stretch or contract. Two of these compensating cables are attached to each elevator, their length varying from 578 to 630 feet.

Safety no less than speed is insured for these express elevators. Thus the speed governor already referred to serves to actuate a wedge-clamp device on the car, and to limit the speed electrically to 700 feet per minute. If a speed of 800 feet per minute is reached, the wedge-clamp safety device works at once, and the car is clamped to the rails. Furthermore, each car has an emergency brake which enables the operator to shut off the power and clamp the car to the rails independently of the speed governor. At the top of the shaft, safety retarding devices check the speed of either car or counterweight in case the ordinary limit of travel is exceeded.

Both cars and counterweights land on patented oil buffers at the bottom of the shaft, which buffers are arranged so as to stop the cars when running at full speed, that is, under 800 feet per minute, and these have been found to work by actual test most effectively and satisfactorily.

The Suez Canal is quite a different affair to-day from what it was when it was opened in 1869. Mr. Vice-Consul Dunlop gives some interesting details of how the canal has been developed to meet the requirements of modern shipping. The entire length of the canal is 100 British statute miles. The navigable dimensions are practically double what they were in 1869, the superficial area having been increased from about 380 to 690 square yards in the ordinary channel and to 880 square yards in the numerous gares or crossing places, the dredging having been so carried out as to exceed the limits originally decided upon. From 1898 to 1904, owing to the increased dimensions of ships, larger gares were begun, some 20 in number, at intervals of three miles, each gare having an effectual length of 820 yards, with approaches of 328 yards at either end. At each gare the bottom width of the canal is 50 yards, the width at the water level being over 100 yards, while the depth of the gare itself is 31 feet. At the same time the depth of the channel was increased, so that on January 1st, 1902, a draft of 26 feet 3 inches was allowed instead of 25 feet 7 inches. On January 1st, 1906, the draft for ships was again increased to 27 feet, and on January 1st, 1908, to 28 feet. The work of deepening the channel is steadily proceeding, with the intention of arriving at a uniform depth throughout.

An Ingenious Way of Examining the Contents of the Duodenum.

The lay mind is apt to consider the advances made in surgery in the last decade of more importance than those in modern medicinal practice. That this popular impression is erroneous is proved by the many devices which have of late years been put to successful tests to enable a physician to examine with the greatest accuracy the workings of inner organs and to restore them to their normal condition without resorting to the surgeon's knife. Notable forward strides in this direction have been made in the study of the digestive organs of the human body, such as examination of the stomach and its contents by the use of a bucket firmly held at the end of a fine cable and let down into the stomach, to fill and be hauled up again for examination by chemical reaction tests, to determine whether the stomach digests normally or abnormally, and thus to enable the physician to diagnose correctly the defects or diseases of the digestive organ.

From the New York Medical Journal we learn that Dr. Max Einhorn, professor of medicine at the New York Post-Graduate Medical School, has succeeded in obtaining samples of the chyme contained in the duodenum by the use of a very simple apparatus called the "digestive juice aspirator," a portion of which instrument is introduced into the duodenum by way of the esophagus and stomach without the slightest discomfort to the patient.

It is well known that primary digestion takes place in the stomach, but the most important digestive action takes place in the duodenum, that is, the part into which the stomach discharges by way of the pylorus, and which also receives the very important secretions from the liver (bile) and the pancreas.

For the purpose mentioned, Dr. Einhorn uses a thin flexible tube terminating in a small metallic perforated capsule, which is swallowed by the patient and passes into the stomach, dragging the flexible tube along in its descent, the tube being sufficiently long to extend a distance out of the patient's mouth.

The capsule in the stomach is acted on by the movement of the stomach wall, as in the case of food. In the course of about an hour it passes by way of the pylorus into the duodenum, and even as far down as the beginning of the small intestine. The outer end of the tube is then connected with a small hand suction pump, the piston of which is gradually withdrawn, so that the duodenal contents are drawn into the perforated capsule and up through the tube into the glass barrel of the pump, which latter is now disconnected from the tube and its contents emptied into a vial for examination. The tube and the capsule attached thereto are then withdrawn.

The immense importance of being able to obtain the chyme directly from the duodenum, especially the lower part thereof, is apparent, as the physician by the subsequent tests made of the chyme obtained, can diagnose accurately and readily determine the proper or improper functioning of the duodenum. The same instrument can, of course, also be used in the stomach, to obtain samples of gastric secretions, during the entire period of stomach digestion, from beginning to end.

The successful use of the simple device described has led Dr. Einhorn to its reverse use, that is, introducing food or medicine directly into the duodenum without first passing it into the stomach in the ordinary way of swallowing the food or medicine. In this case, the food or medicine in liquid form is filled into the barrel of the pump and after the introduction of the perforated capsule into the duodenum, as above described, the pump is attached to the outer end of the tube, and the pump is actuated by hand to force the food or medicine through the tube and perforated capsule directly into the duodenum. This treatment has been successfully used in several cases.

Correspondence.

WEIGHT DISPOSITION IN AEROPLANES.

To the Editor of the SCIENTIFIC AMERICAN:

I was much interested to read the letter of C. E. McCluer of Norfolk, Va., in your issue of April 9th concerning monoplanes, and the disposition of weight below the level of the supporting planes.

In a letter I wrote to the Wright Brothers at the time of the unfortunate accident, in which a valued officer of the United States army lost his life, I advocated the very principle set forth by Mr. McCluer, and confidently believe still that the adoption of that method will preclude the possibility of the recurrence of such accidents.

In the letter referred to are sketches illustrating the idea, and showing the same in comparison with a bird in the act of flight. The whole thing was submitted without any mercenary motive, and was simply for the reason already stated.

As a mere student of aviation I submit the foregoing in the hope that you will publish the same, as it may lead to experimentation. ROBERT W. MATTHEWS.

Lock Haven, Pa.

WEIGHT DISPOSITION IN AEROPLANES.

To the Editor of the SCIENTIFIC AMERICAN:

Mr. McCluer's letter in the issue of April 9th exemplifies an error only too common among people who take an interest in aeroplanes. Placing the center of gravity low in an aeroplane introduces many objectionable features, which more than outweigh its advantages. Far from having a stabilizing effect, the low center of gravity makes the machine more unstable than ever, and calls for great skill on the part of the aviator to maintain an upright position.

This is due to the pendulum effect of the suspended weight. When the propeller attempts to accelerate the machine by increasing its forward thrust, it is resisted by the inertia due to the machine's weight; and if the center of gravity is below the center of the propeller, the machine will tip forward.

Likewise on a turn, the suspended weight tends to swing out in a larger circle than center of the supporting surface, where the resistance is concentrated, and so tends to depress the inner wing; just the contrary of what Mr. McCluer assumes would take place. This disturbing tendency is in addition to the depression of the inner wing due to its slower speed.

Mr. McCluer's analogies to natural forms have much that is good in them, and like him I favor the monoplane; but I believe that soaring birds will be found, on closer observation, to keep their weight well up on their wings. The only safe principle for an aeroplane is to have the centers of gravity, thrust, and support as nearly as possible coincident.

New York. G. H. GODLEY.

THE "KINKS" IN THE NEGRO'S HAIR.

To the Editor of the SCIENTIFIC AMERICAN:

The texture of the hair is one of the physical variations, differentiating the negro from the Anglo-Saxon, Celt, or Teutonic races. But what causes the "kink" in the hair of the negro? For centuries and centuries the ancestors of the United States negro have lived in the dense forest and heat of the torrid zones of Africa, the atmosphere of which has been surcharged with sodium, calcium, magnesium, sulphureted hydrogen, ammonia, iron, and other chemical substances. Besides these and other known metals, the atmosphere has in it various gases, which it holds in suspension. In the presence of these atmospheric solid and gaseous substances coupled with a constant very "humid condition" of the atmosphere, we have the unprotected scalp of the indigenous native, with the powerful actinic rays and heat of the tropical sun acting directly upon the head of the "Homo Africanus," both as an irritant and a trauma. This excites a condition known to the pathologist as an inflammation. With this condition of inflammation of the skin of the head, there follows a congestion and proliferation of the blood vessels of the skin of the scalp with the following result: The sudoriferous and sebaceous glands together with their excretory ducts become hypertrophied. This makes the entire dermis and epidermis thickened and indurated, as the glands of the skin pour their contents out upon the surface of the skin, to go through the process known to chemists as oxidation, which produces heat. According to the well-known principle, cold contracts but heat expands, there occurs an alternate contraction and dilatation of the longitudinal and transverse bands of connective tissue and the thin muscle fibers that connect the papilla, in which the shaft of the hair is growing. This alternate contraction and dilatation of the muscle arrestor pili acts as a sort of a "guy-rope," pulling the hair follicles and shaft first in one direction and then in another, with the following result: The hair as it grows from the root to the epidermis, becomes curved or oval shaped. The shaft of the hair, as it passes through this curved course, takes on an oval shape, which becomes or is known as the "kink." The heat generated by action of the integuments of the skin in the presence of the atmosphere tends to harden the outer sheath of the hair, and gives to it its permanent character.

In the temperate zone of the United States, where the humidity of the atmosphere is not so dense, with our abundance of sunlight, where the atmosphere is not so heavily impregnated with metallic corpuscles and gaseous substances, and where the Afro-American's head and scalp are protected by the ordinary headgear, removed also from beneath the direct rays of the torrid, tropical sun, the etiological factors which have been operating for ages and ages to make the Afro-American's hair *encomic* will, in time, make his hair enthycomic. The modern science of anthropology no longer teaches that "Homo Europeaus" is of an "Indo-European" origin, but Sergi makes the affirmation that "Homo Caucasicus" is of a Mediterranean origin. Ripley (see "Races of Europe," p. 175.) "The Mediterranean population are an offshoot and development from the African negro" (See Darwin's "Descent of Man," p. 171.) The probable and acceptable hypothesis is stated by Arthur M. Marshall in his biological lectures, 1894, p. 24, who says: "The white races of Europe had their geographical genesis in Africa and spread thence in paleolithic and neolithic times over the whole of Europe. The white races of Europe and America are therefore of a negro origin, and the same causes and elements of nature that have depigmentized the skin and straightened the hair of "Homo Caucasicus" will, in time, produce the same results in the Afro-American's skin and its appendages. J. M. BODDY.

St. Paul, Minn.

HALLEY'S COMET.—A MODEL OF ITS ORBIT.

BY JAMES K. LYNCH, GEORGETOWN COLLEGE.

For the large number of people now interested in the famous Halley's comet who have found difficulty in obtaining an intelligent idea of its motion in space, its apparent motion in the sky, and the times of its visibility, a cardboard relief model, like that of which a photograph is herewith reproduced, will be of great assistance. And even those who already understand the phenomena from the study of plane diagrams may obtain a much clearer idea of them from the model, because it is much more concrete, and represents the sun and the orbits of the comet and the earth as they really exist in space, and not as they are often shown by being projected on the same plane.

In order that the readers of the SCIENTIFIC AMERICAN may easily construct such a model for themselves, patterns or diagrams are printed on the accompanying loose-leaf supplement, which when pasted on cardboard, cut out, and properly fitted together will make an excellent model.

After telling how to construct the model, some description will be given explaining how the astronomical phenomena may be studied from it.

Having first pasted the loose-leaf on a sheet of cardboard, about 10-ply, cut out the three diagrams along the dotted lines. Also cut a narrow slot through the planes of both the comet's and earth's orbits at the places marked. Then insert the planes into each other as far as the slots will allow, keeping the earth's orbit below that of the comet on the right, but above it on the left.

If the two planes are correctly fitted together, they will now produce the general effect shown in the photograph. But besides having the model rigid, the two planes must be given the necessary inclination to each other of approximately 18 degrees.

Fasten the two planes together by pasting two small muslin hinges in the angle between them, one on each side of the sun, keeping the slots in line. Then bending over the flaps of the triangle along the two lines marked on it, paste it as a wedge between the plane of the earth's orbit above and the comet's below. This completes the model.

The reader will observe that the comet's position is indicated at intervals of ten days before and after perihelion as it travels in its orbit in the direction of the arrows. The earth's position as it yearly moves about the sun in the opposite direction is also shown for the same days. The printed side of the model faces north.

Examining the comet's path in space, we see that it cuts through the plane of the ecliptic at the ascending node, symbol ☊, in January. On April 19th it was at perihelion. On May 18th-19th it cuts through the plane of the ecliptic at the descending node.

During the early part of the year, the comet and the earth moved on roughly parallel lines. Hence the comet grew brighter only by a change in its intrinsic brilliancy. Now however the orbits are rounding in toward each other, and the comet will be more conspicuous because it is approaching the earth.

The tail is always directed away from the sun. Hence in March it was much foreshortened for us. Now it is becoming more nearly perpendicular to the line of sight, and will soon be seen more in its full length.

The time of visibility of the comet will depend on whether it is to the left or right of the sun as seen from the earth. To transfer correctly to the sky left and right on the model we should imagine the sun on the meridian at noon with the comet to the left or right. Taking the way that common observation shows the sun to move across the sky from east to west, on account of the earth's daily rotation, it is easy to see that any body that is to the left of the sun at noon will rise and set later than the sun, and anything to the right at noon will rise and set earlier than the sun.

Hence before March 25th the comet, being to the left of the sun, rose in daylight but set after the sun and was visible in the evening. At present it is to the right of the sun and rises before it in the morning, increasing its distance until May 8th, when it reaches its greatest western elongation. It then approaches the sun, and comes into inferior conjunction on May 18th-19th.

As the three celestial bodies are also in the same plane on this date, the circumstance makes it possible for us to go through the comet's tail if it is long enough to reach us. What we shall see on that night it is not the purpose of the present article to consider, but it may be said that as the moon is then approaching full, a fact which has been somewhat overlooked, we may not see anything at all.

The comet and the earth are fourteen million miles distant May 18th-19th, but their closest approach occurs a day later, when they are thirteen million miles apart. The closest approach of the orbits is at a point a little below to the left, where the comet's orbit is six and one-half million miles below the earth's. On diagrams where both orbits are projected on one plane they apparently intersect at this point. Hence some people have imagined a possible collision here, but the orbits never intersect, as the model shows.

On and after May 20th, as the comet is to the left of the sun in the model, it will again be visible in the western sky, being seen as soon as it is dark enough, and setting about two hours after sunset, which time will gradually increase to four hours by the end of May. But as the two bodies are then receding in almost opposite directions, and the tail is turning more and more away from us, the glory of Halley's comet will soon be lost to us for three-quarters of a century.

The Current Supplement.

The new 60-inch reflecting telescope of the Mount Wilson Solar Observatory has been in operation for about one year. A description of this wonderful instrument, and the work which it does, is presented in the current SUPPLEMENT, No. 1791, by E. A. Fath. Sven Hedin's big "Trans-Himalaya" is reviewed. Halley was not only the first to predict the return of a comet, but also to devise a method of determining the age of the ocean from chemical denudation. George F. Becker comments on his work. The ancient decimal bead frame is still in actual use, side by side with the very latest adding and listing machines. This ancient bead frame, the Chinese abacus and its Japanese twin brother, are described by Mr. Daniel Arthur. Dr. Jean Charcot presents the results of his Antarctic expedition. Henry A. Wise Wood contributes an excellent paper on "Modern Stereotypy and the Mechanics of the Newspaper." "Substitutes for Rubber" is the title of an article which must undoubtedly attract attention because of the present rubber boom. Under the title "Mechanical Oddities" some curious inventions are described. The design of aeroplane motors is discussed. A. Melin suggests an improvement in aeroplanes. A box with a secret opening is described and illustrated.

Mercury Arc Patents Granted.

After six years' contest, Mr. Peter Cooper Hewitt has been awarded patents for his mercury vapor electric lamp. The patents have been in interference almost since the date when they were first applied for in 1901. Mr. Hewitt's chief opponent was the General Electric Company.

In accordance with the recent decision affecting the classification of articles under the Tariff Act of 1909, the United States Treasury Department has instructed customs officers to admit free of duty all miners' safety lamps, whether electric or designed for using oils or other illuminating materials, with or without glass chimneys, and whether imported as an entirety or in separate parts, together with any apparatus for locking or unlocking such safety lamps, for testing or detecting flaws in these lamps, or for cleaning them of dust particles, etc., together with all miners' rescue appliances and parts thereof, such as helmets, special tubing of valves, special oxygen cylinders, refilling oxygen pumps, and all other essential parts of the complete outfit, whether imported as entireties or in separate parts.

THE MOTOR-BOAT RACES AT MONACO

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN

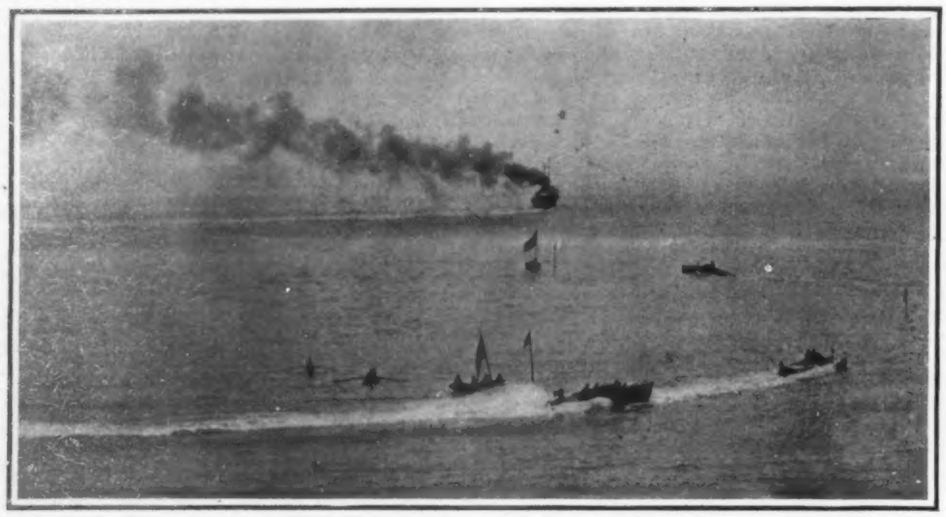
The motor-boat races at Monaco and Monte Carlo this year were noteworthy on account of the extremely high speed which was attained, according to the cable dispatches. There were a score or more of boats in the races, which were favored with excellent weather that made possible the attainment of great speed, especially in the long-distance events.

The first long-distance race for the Championship of the Sea was held on Sunday, April 10th. Count de Pourtale's "Cocorico" readily won this 200-kilometer (124.2-mile) race in 4 hours, 22 minutes, 35 2-5 seconds, at a speed of 28.31 miles per hour. Out of the 36 competitors in this long-distance race for cruisers the "Tele-Mors," "Calypso," "Gregoire VIII." and "Spagallinari" finished in the order given.

The race was an exciting one, as several of the boats were quite evenly matched. The Brasier-Despujols hydroplane, which was one of the novel craft that raced this year, did very well and showed good speed in proportion to its horse-power. In the second great international race for the Coupe des Nations, which took place on April 12th, this boat was second, finishing but 7 minutes and 47 seconds behind the "Ursula," which completed the 100 kilometers (62.1 miles) in 1 hour, 26 minutes, 59 2-5 seconds. The Brasier-Despujols averaged 39.1 miles an hour, against 42.83 miles an hour of the "Ursula." She was fitted with a Brasier 4-cylinder engine of 100 horse-power, while the "Ursula" had two 12-cylinder motors totaling 800 horse-power. One of our photographs shows the twin screws of the "Ursula." Her engines are arranged side by side, one on each side of the hull. Another photograph shows the "Ursula" at full speed, while a third picture shows the Brasier-Despujols. The difference in the amount of spray thrown by these two boats is interesting; the former cuts through the water with very little disturbance, while the latter skims over it with a good deal of splashing. The great regularity with which the "Ursula" speeded around the course for nearly an hour and a half astonished many of the spectators, and was an excellent testimonial to the design and construction of the Wolseley-Siddeley motors that drove her. She was piloted by her owner, who steered her with great steadiness. He took the turns without slowing down, and at each turn the boat would tip dangerously. The "Ursula" showed herself to be one of the fastest motor boats that have ever been built; but in the mile and kilometer speed trials she did not make anything like the time that she is reported to have accomplished in the long-distance races. In fact, the hydroplane beat her in the speed trials, owing to its ability to get under way quicker. The times of the mile from a standing start and of the flying kilometer trials by the Brasier-Despujols and the "Ursula" were as follows:

	Mile.	Kilometer.	Miles an Hour.
Brasier-Despujols	2:20	....	25.71
Brasier-Despujols	....	50 2-5 sec.	44.35
Ursula	2:36 2-5	....	23.02
Ursula	....	55 2-5 sec.	40.35

The "Ursula" this year is fitted with the same two 12-cylinder Wolseley-Siddeley motors that were used last year. As her best speed then was about 37 miles per hour, it is fair to assume that the figures given in the cabled reports are not correct, or else that the distances around the course were less than supposed. It is extremely doubtful if the Duke of Westminster's racer averaged more than this figure in the long races, especially since she made only 40.35 miles an hour in the flying kilometer speed trial. We understand that on account of the great depth of the water where the races are held, there is oftentimes a shifting of the buoys owing to the inclining of the anchor lines, and that this causes a shortening of the course. The mile and kilometer tests are therefore the only ones in which any great degree of accuracy is obtained, and as experience has shown that in a long-distance race a boat will make less speed, if anything, than in a short speed trial, it seems certain that the "Ursula" has not shown much more than 40 miles an hour so far. That she should have averaged 42 miles an hour with the same power plant as heretofore is very creditable.



Three of the contestants making a turn in the "Championship of the Sea" race.

Stern of the "Ursula," showing rudder and twin screws.

An Aeroplane Flight with Five Persons, and Cross-Country Flying in France.

One of the most remarkable performances ever made with an aeroplane was that of Roger Sommer's new biplane last week in France, when, piloted by its constructor, it carried him and four other persons in a five-minute cross-country flight. On this occasion the aeroplane lifted some 750 pounds of dead weight, or probably a total weight of 1,800 pounds, with presumably a 50-horse-power motor.

Another demonstration of the development of the heavier-than-air machine was given on April 18th by Louis Paulhan, who flew from Orleans to Arcis-sur-Aube (118 miles) in 3½ hours on his Farman biplane. The next day he flew 43½ miles farther across country in 1 hour and 10 minutes, reaching a height of 750 feet. Henry Farman, on the 17th instant, also flew 40 miles across country with a passenger.

These brilliant flights form an ocular demonstration of the great advance recently made in dynamic flight, and point the way to the practical utilization of the aeroplane for the transportation of individuals and of mail.

The Electrical World states that at a recent miners' convention in Indianapolis the opposition of mine workers to electric power, the introduction of which they consider against their interests, was manifested in a resolution declaring that the use of electricity in mines is hazardous, as the leakage from poorly insulated wires has a tendency to ignite mine gases and frequently causes explosions.

The Brasier-Despujols hydroplane at full speed.

This boat made 44.35 miles an hour in the flying kilometer speed trial.

The Duke of Westminster's "Ursula" speeding in Monaco Bay.

Besides winning the 62.1-mile Coupe des Nations race this 800 horse-power speed craft made 40.35 miles an hour in the flying kilometer test.

THE MOTOR-BOAT RACES AT MONACO.

THE MANUFACTURE OF CELLULOID

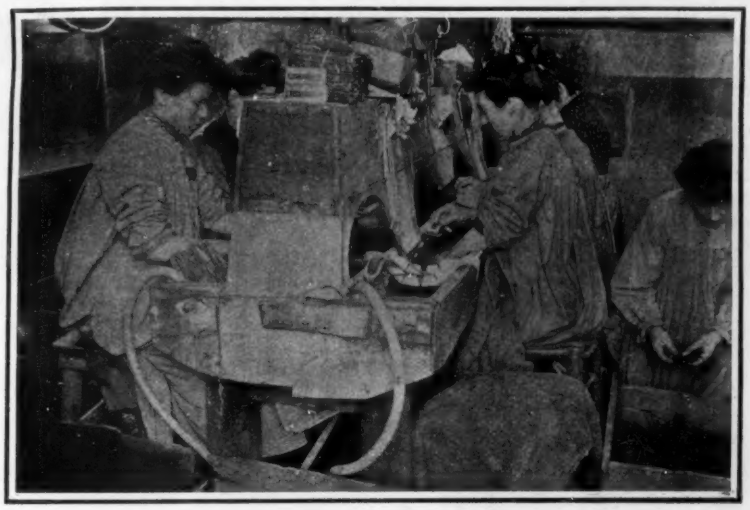
BY JACQUES BOYER

More than sixty years ago chemists began the search for substances of which imitations of horn, tortoise shell, and ivory could be made. One of the first experimenters, Dr. Pierson, of New Orleans, furnished a theoretical solution of the problem in 1848, by the discovery of celluloid, a complex substance consisting chiefly of nitrocellulose and camphor, but no industrial application of celluloid was made until a much later date.

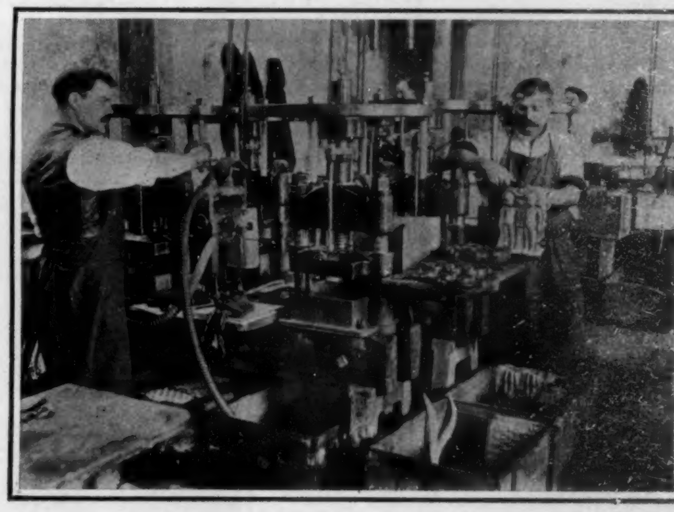
In 1862 Parkes, of Birmingham, obtained a similar substance, which he named "parkesine," by mixing guncotton with wood naphtha. The hardness of parkesine limited its applications, and it was employed chiefly as an electrical insulator. In order to soften it, caster oil was added to the mixture and, afterward, the naphtha was replaced by methyl alcohol. Parkesine obtained a temporary success in England, but it was driven out of the market by the cheaper celluloid, the manufacture of which was begun by the Hyatt brothers, in Newark, New Jersey, in 1867. Other large celluloid factories were subsequently established in America, France, England, and Germany.

Celluloid is now made from a very pure form of cellulose, usually obtained from cotton or unsized filter paper. The cellulose is converted into nitrocellulose by methods which vary somewhat in different factories. Among the processes most commonly used is the following: The material—raw or spun cotton, or paper chopped or cut into strips—is immersed in nitric acid for a period ranging from fifteen minutes to two hours, according to the character of the fibers and the temperature of the bath. The cotton or paper, now converted into nitrocellulose, is taken out, wrung and pressed to remove most of the adhering liquid, which may or may not be returned to the nitrating bath. In either case, the strength of the bath is restored to its original value by the addition of concentrated nitric acid.

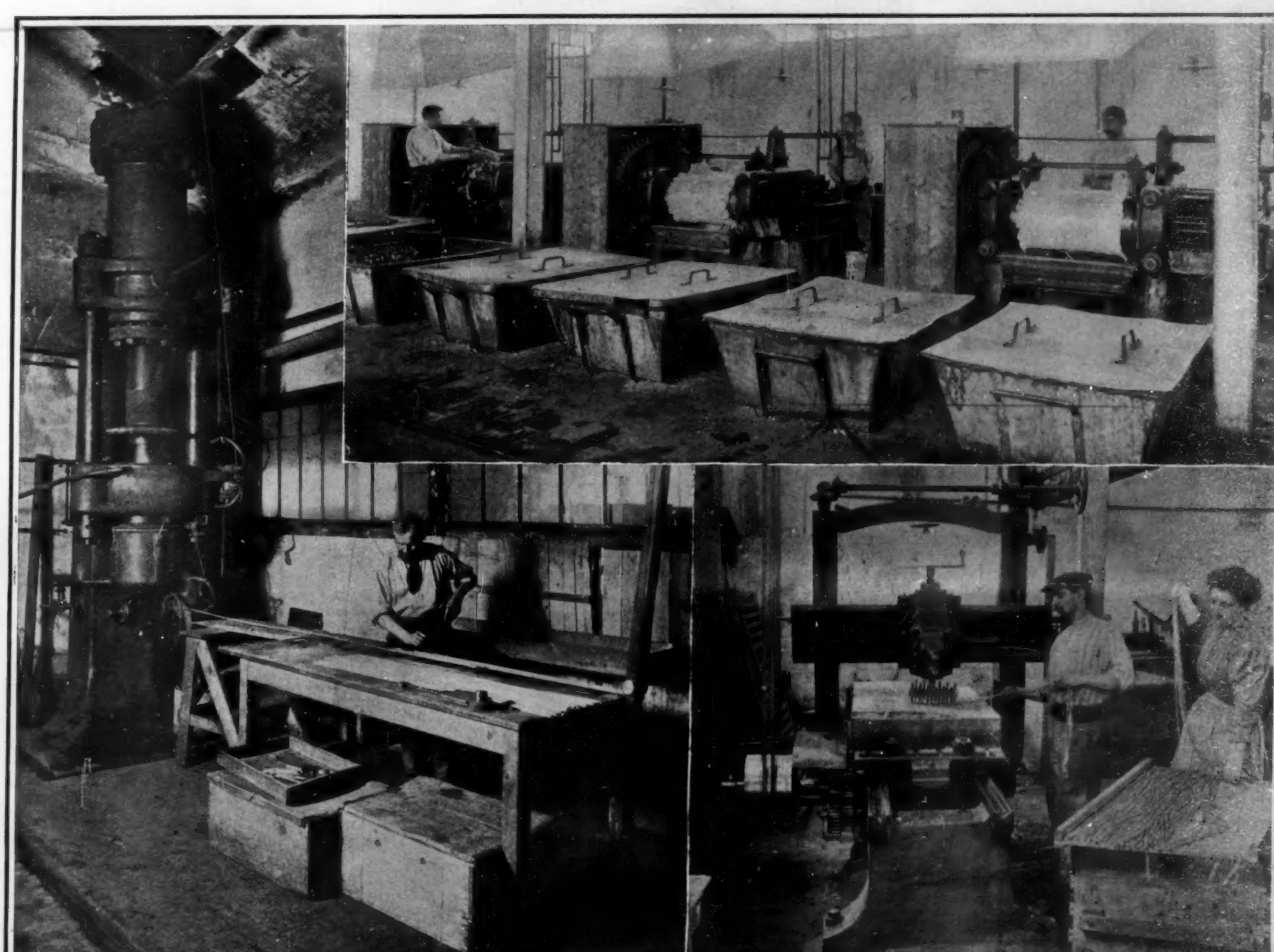
The nitrocellulose is washed in water and ground in a paper mill, in which a rotary movement is impressed upon the mass as it is forced between a plate and two cylinders which rotate at a speed of 160 revolutions



Bending celluloid hairpins.



Blowing celluloid dolls.



Drawing tubes of celluloid. Rolling sheets of celluloid. Cutting out celluloid rods.

THE MANUFACTURE OF CELLULOID.

per minute. The cylinders are set with steel blades, parallel to the axis, and the plate bears a number of steel blades, slightly inclined to those of the cylinders. The finely ground nitrocellulose next goes to the bleachery, where it is treated with chlorine, hydrogen dioxide, sulphurous acid, potassium permanganate and other decolorizing agents. It is then washed thoroughly, pressed between rollers, and dried.

Celluloid is made by dissolving nitrocellulose in an alcoholic solution of camphor. Some manufacturers mix the camphor with the moist product of the roller presses, which contains 40 per cent of water, while others add the camphor to the dried nitrocellulose. In the former case the moist pulp, camphor and coloring matter are ground together between horizontal, circularly fluted iron "millstones." The mixture is passed several times through this mill, and is then dried. When the nitrocellulose is dried separately the lumps formed in the passage through the roller press are crushed by rubbing the pulp, with the hand, through a coarse wire screen.

Drying is effected indirectly by pressing the pulp between layers of absorbent material. The pulp is spread on a cloth which is turned up over it, forming a rectangular cake 24 inches long, 20 inches wide, and about ⅝ inch thick. In the factory of the Société Industrielle du Celluloid these cakes are piled alternately with dry felts, a sheet of iron being introduced after each ten or fifteen cakes, in order to facilitate handling. The pile is then subjected to a hydraulic pressure of about 250 tons. After a few minutes of this violent compression, the now wet felts are replaced by dry felts and the operation is repeated until the nitrocellulose is dry. The compressed cakes are now unwrapped and broken into fragments for solution. If the camphor has been added before drying the broken cakes are simply sprinkled with alcohol, but if the dried nitrocellulose contains no camphor it is moistened with a solution of 90 parts by weight of camphor in 100 parts of alcohol.

The solvent is allowed to act for 24 hours, and then the mass is rolled between hollow iron cylinders, from 12 to 26 inches in diameter, which make 10 revolutions per minute, and are cooled or heated, as desired, by a circulation of cold water or steam in their interior. From 65 to 130 pounds of celluloid are rolled at a time, the rolling being continued from half an hour to several hours. Toward the end of the operation the cylinders are brought close together in order to produce a thin sheet of celluloid longer and wider than the press by which the sheets are converted into blocks. The rolled sheets are trimmed to the exact dimensions of the press, and the trimmings go back to the rolling mill.

In the Champigneul block press a strong iron box, 54 inches long, 26 inches wide and 12 inches high, is filled with sheets of celluloid, and these are converted into a single block by pressing between two iron plates. The top plate is fixed in position, while the bottom plate is carried by a plunger which enters a cylinder below and is forced upward by hydraulic pressure. A pressure of 250 tons is applied for a period varying from 5 to 12 hours, during which the celluloid is kept at temperature of from 158 to 194 deg. F. by a circulation of hot water in the interior of the plates and the double walls of the box. The mass is cooled by substituting cold for hot water, the pressure being continued during the cooling. The top plate is then removed and the block of celluloid is forced out of the top of the box by again applying pressure from below.

The blocks are cut into bands or rods according to the purpose for which the celluloid is to be used. The bands are cut by a machine in which a knife, the edge of which is inclined 40 degrees to the horizontal, is forced downward by a screw. In this way, bands varying in thickness from 1/250 inch to 1¼ inch can be obtained. Celluloid is cut into rods or fibers by a machine in which the cutting tool has the form of a short cylinder of diameter varying according to the size of rod desired.

The celluloid, after it is cut up, is dried in chambers where the temperature is never allowed to exceed 113 deg. F. on account of the danger of explosion. The time required for desiccation varies greatly with the thickness of the bands or rods. Bands thinner than 1/100 inch dry in a few hours, while strips thick enough to be used in making knife handles, for example, must remain in the drying chamber about six months.

Tubes of celluloid are made directly from the rolled sheets in an apparatus which comprises two vertical cylinders, with their axes in the same line and their pistons connected by a stout rod. The bottom of the lower cylinder has a central orifice, to which annular apertures of various dimensions can be adjusted, and the lower part of the cylinder is heated by a circulation of hot water. The celluloid is introduced into this cylinder and hydraulic pressure is applied by means of the cylinder above. The celluloid, softened by the heat, is thus forced through the aperture in the form of a tube, which the operator draws away and cuts into convenient lengths by means of a clamp attached to a cord passing over reversible pulleys.

To return to the bands of celluloid which have been cut from the pressed blocks. In the drying chambers these bands become warped. They are flattened in a hydraulic polishing press which exerts a pressure of about 1,000 tons. The celluloid bands are piled alternately with sheets of polished brass or nickel-plated steel, a thick plate of cast iron covered with cloth or felt being inserted after each four or five bands. These iron plates contain channels for the circulation of steam or cold water. While the pressure is applied the plates are first heated by steam to 180 or 190 deg. F. for a few minutes and are then cooled by cold water. When the bands are taken from the press they are found to have acquired the high polish of the sheets of metal which were in contact with them.

Before describing the subsequent transformations of the bands, rods and tubes of celluloid, the method of producing striped, veined, and marbled effects should be noted. For this purpose two blocks of celluloid of different colors are made separately in the block press and cut into bands about 1/100 inch thick. A pile of these bands, arranged in alternating colors, is sliced with a powerful paper knife. The fine strips of celluloid of two colors resulting from this operation are arranged regularly or irregularly in the block press and converted into a solid block of striped, veined, marbled or "watered" appearance.

Flattening celluloid bands that have warped in drying.

THE MANUFACTURE OF CELLULOID.

From the bands, rods and tubes of plain and variegated cellulose, objects of every form and character, presenting the appearance of ivory, tortoise shell, mahogany and other woods, coral, amber, jade, malachite, silken fabrics, etc., are made by various operations, of which the most important are shaping, cutting out, molding, curving, blowing, varnishing and decorating.

Celluloid, like wood, horn and ivory, is usually shaped by hand, with the chisel, drawing knife, rasp, etc. Celluloid hair pins are pointed on the emery wheel. Shaping is done also on the lathe in the factory of the Société Industrielle du Celluloid. The cutting out is done preferably by machine, with punches, circular and band saws, and cutting wheels with straight and fluted edges. A wheel of special form is employed to cut out pairs of interlocking combs, which are finished on lathes and molding and other machines. Flat objects with curved contours are cut out with band saws. A number of sheets are cut at one operation, oiled paper being interposed between the sheets of celluloid to prevent the sawdust clogging the saw.

Curving is effected by taking advantage of the plasticity which celluloid acquires on being gently heated. Celluloid hair pins, for example, are immersed in hot water, bent by hand on a metal form and then hardened by being plunged into cold water. These operations must be performed with skill and care, as celluloid becomes white and opaque when heated too strongly.

Celluloid objects of the utmost variety of form are produced by molding, in which operation the softening influence of heat is again utilized. The object, approximately shaped by other methods, is inserted between the two segments of a bronze mold, which are in contact with the heated plates of a steam press. When the celluloid has become sufficiently plastic, the plates are forced together, and the celluloid assumes the exact form of the mold, which it retains after cooling. Leaves, petals of flowers, and similar small thin objects of celluloid are shaped by stamping with dies.

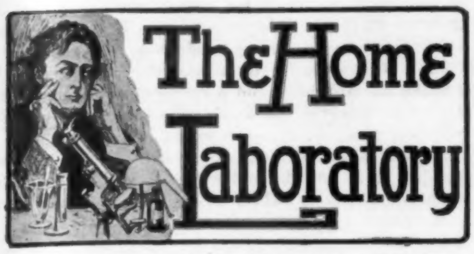
The operation of blowing is performed on celluloid tubes as they are drawn from the press. A tube of suitable dimensions is placed in a heated mold composed of two or more segments and, when soft, is inflated by a blast of high pressure steam which forces the celluloid into contact with every part of the mold, which is cooled before opening. In this way whisk broom covers and similar cup-shaped objects, as well as dolls, animal figures and other toys are made. The parts of celluloid boxes and other built-up objects are sometimes joined by means of acetone, acetic acid or other solvents of celluloid. Cheap boxes are varnished with a solution of celluloid in acetic acid, which saves polishing with pumice stone.

For decorating the surface of celluloid, aniline colors dissolved in alcohol are employed.

Air Resistance Experiments.

A useful critical comparison of the work of Frank and Eiffel is presented by W. Schule in the Zeitschrift des Vereines Deutsch Ing. The law that resistance is proportionate to the square of the velocity has been verified by Frank for velocities up to 6 m./sec., and by Eiffel from 15 to 40 m./sec. The specific resistance is proportional to the normal area, and this resistance does not reach its maximum with an area of 1 sq. m. (Eiffel). The results of Frank for right circular cylinders and cones of various angles are in contradiction to those of Eiffel. The error is considered to be on the side of Eiffel; and further, the resistance deduced by the latter from his experiments with inclined plates requires substantial correction. The resistance of an inclined plate increases very quickly with the inclination of the plate up to 30 deg., and much more slowly thereafter. Frank's coefficient for the surface friction of plates moving parallel to their length, viz., 0.00244, shows that the resistance of such a plate is 236 times less than that for the same plate moving along the normal. This coefficient agrees well with the resistance coefficient of vapors and gases in motion through tubes. In the region from 10 deg. to 0 deg. plate inclination, the surface friction is of prime influence on the specific resistance. Employing Frank's law of friction along with Eiffel's results for plates inclined at 20 deg. to 30 deg., the air-resistance may be found for the region of most importance in flying technique, viz., between 0 deg. and 15 deg., at 5 deg. inclination, the resistance *R*, referred to the unit of surface projection, passes through a minimum value (k min. $= 0.1$ in the formula $R = k \times$ area $\times$ air density $\times$ velocity$^2/g$). Air-resistance is composed of three parts—the acceleration resistance, and friction, external and internal. External friction only becomes of importance for angles of 15 deg. inclination and less. The direction of the resultant thrust on a plane surface only begins to deviate from the normal for plate inclinations of 5 deg. and less; for 5 deg. the deviation is 4 deg. from the normal, and for 1 deg. it is 24 deg. The ratio of upthrust to moving force for an inclined plate in motion is greatest for an inclination of 5 deg., and the absolute upthrust reaches a maximum for the angle for 32 deg.

Celluloid watch crystals have appeared, and are guaranteed not to break like those of glass. The celluloid crystals are not favored by dealers in the higher grades of watches, but are placed on cheap timepieces. Of late the German manufacturers have been employing these crystals. They cost a little more than glass, but are liked because of their durability.



TELESCOPE LENSES AND HOW TO TEST THEM.

BY PROF. S. A. MITCHELL, COLUMBIA UNIVERSITY.

The arrival of Halley's comet and the interesting changes in its appearance noticed by the keen-eyed astronomer using a powerful telescope have naturally caused the uninitiated to inquire into the use of these glasses, and to wonder how much their eyes could see if a telescope were put at their disposal. Certain

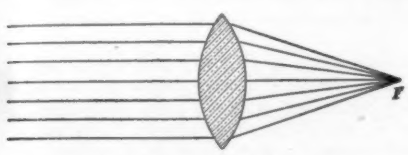


Fig. 1.—FOCUS OF A LENS.

it is that the first look through a large telescope would be disappointing, for nothing appears as big or as magnified as expected. The beginner is apt to believe that he could see the whole moon at once and as if only a few miles away, but is amazed to find he can see only a small portion of it and that shimmering and dancing in a purple haze. He may admire the beauty of the color not knowing that this is caused by an imperfection of the telescope which cannot, unfortunately, be got rid of. Indeed, the moon presents a prettier picture in a three- or four-inch telescope than it does in anything bigger. It is in the hope of explaining the simple things about a telescope that this article is written.

It is sometimes thought that a telescope is powerful because the rays of light pass through a large number of lenses placed at intervals down the tube. This idea, like many another popular one, is entirely erroneous. The telescope gets its power mainly from the objective which causes the rays of light coming from the object under observation to converge, and if not intercepted form an image.

The action of a simple lens is easily understood. If parallel rays of light fall on the lens in the same direction as the axis of the lens they will (Fig. 1) converge to a point *F*, called the principal focus; and similarly, rays from *F* will emerge as a parallel beam. *F* may be on either side of the lens, and it is imma-

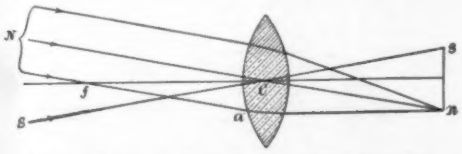


Fig. 2.—FORMATION OF AN INVERTED IMAGE.

terial in which direction the light goes through. The distance from *F* to the lens is the focal length. Next, if we have a parallel beam not in the direction of the axis (Fig. 2). It will likewise converge to a point, different from *F*. If we neglect the thickness of the lens, a ray through the center of the lens *C* will pass through undeviated; a ray *fa* through *f* the focus will emerge parallel to the axis. Rays from the north of the moon, *N*, will be brought to a focus at *n*, and from the south edge of the moon, *S*, to the point *s*. Hence the lens forms a real image at the focus, so that if we placed there a ground-glass or a photographic plate we would obtain a picture of the moon. This image is *inverted*.

Three different ways of using the convergent pencil of rays from the object glass give three different kinds of telescopes. If the rays before they came to a focus fall upon a double concave lens we have the Galilean telescope, a principle which exists in the modern opera glass. This gives an erect image. If the image at the focus is examined with a double convex lens, a "magnifying glass," we have the astronomical telescope, first invented by Kepler. This gives an inverted image. If the image is examined by three double convex lenses, a compound microscope which again inverts the images, there results the terrestrial telescope, and objects are seen erect.

In the century following Galileo, telescopes were made of enormous length, frequently being over one hundred feet long, and one was made with a focal length as great as 600 feet. The older opticians had found that if they attempted to increase the size of the objective, it was necessary to still more increase the focal length in order to obtain a clear field. The reasons are plain: rays falling on the middle of a simple lens are brought to a focus at a different point from those falling on the edge of the lens, as is shown in Fig. 3. The distance from *F* to *G* gives the amount of the "spherical aberration." Even more trouble was caused by the "chromatic aberration;" the

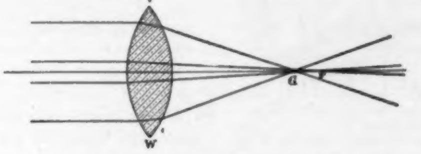


Fig. 3.—SPHERICAL ABERRATION.

star images had a great amount of color surrounding them. A lens may be regarded as a round prism. Since a prism not only deviates light but breaks it up into the spectrum colors, a simple lens will act as is shown in Fig. 4; the violet light is most refracted and is brought to a focus at *v*, the less refrangible red comes to a focus at *R*, with rays of the other colors in between these two extremes. The result of all this is that if we focus for the yellow, the red and violet form rings around this and a star image is surrounded with a considerable amount of color. Sir Isaac Newton was the first to explain these aberrations, and it is singular that although he made experiments to prove that glass and water disperse light differently, he did not forestall Dolland's discovery (150 years ago) of making an objective from a combination of two lenses, one a double convex lens of crown glass, the other a double concave lens of flint glass.

With such a combination the optician has four surfaces to figure, and as a result it is possible to almost entirely eliminate the spherical aberration, or in others words make a flat field. But on the other hand it is still impossible to get entirely rid of color. Flint

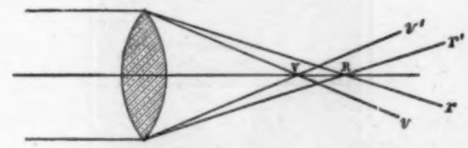


Fig. 4.—CHROMATIC ABERRATION.

and crown glass do not disperse light alike, the flint relatively widens out the violet end the more. The optician with glass of two different sorts at his disposal can bring two colors of the spectrum to a sharp focus. For a visual telescope the rays generally taken are the yellow and the blue green. Consequently both the red and the violet ends of the spectrum are not in sharp focus, and these form rings about the stellar image which combine to make purple color. In small telescopes this color is not so pronounced, but with large telescopes of 24 inches or more aperture the color is conspicuous and cannot be got rid of. This is known as the "secondary spectrum."

The problem of making a good visual lens is really a much simpler one than that of making a good photographic one. In the first place, in the ordinary telescope for visual purposes, the field is comparatively small, of only a few minutes of arc, and the process of making a field flat over the area is simple compared with that required in an instrument like the Bruce photographic telescope of the Yerkes Observatory, which photographs an area in the sky 16 deg. square. With refracting telescopes the ratio of aperture to focal length is about in the ratio of 1 : 15 (the Yerkes 40-inch has a focal length of about 750 inches, a ratio of nearly 1 : 19). In a photographic telescope,

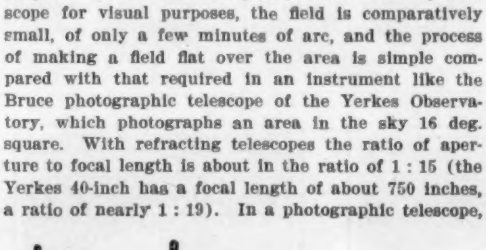


Fig. 5.—COMBINATIONS OF LENSES FOR RAPID PHOTOGRAPHIC WORK.

for the portrayal of a comet, for instance, as short exposures as possible are desired, and this calls for as great a ratio of aperture to focal length as possible. The ordinary amateur's camera works very well at a ratio of aperture to focal length of 1 : 16. If the lens is opened to 1 : 8 the photograph is not so sharp. Only lenses of the best makes can be used at 1 : 5. (Fig. 5.) Everyone who is familiar with the use of a camera knows how much sharper a picture is obtained by stopping down the lens. To obtain a flat field from a lens with an aperture of 1 : 5 is impossible with only two lenses; three or more are necessary. Using glass of different indices of refraction which is possible from the fine qualities of Jena glass now procurable, separating the lenses properly and grinding their surfaces to the right curves, it is possible to obtain a flat field with an absence of color and astigmatism. (Fig. 6.) The Bruce photographic telescope has an aperture of 10 inches with focus 50 inches. It is a 4-lens combination, technically known as a "doublet."

Every skillful amateur knows how to test a photographic lens. This is perhaps done as well as any other way by the test cards for astigmatism, to see

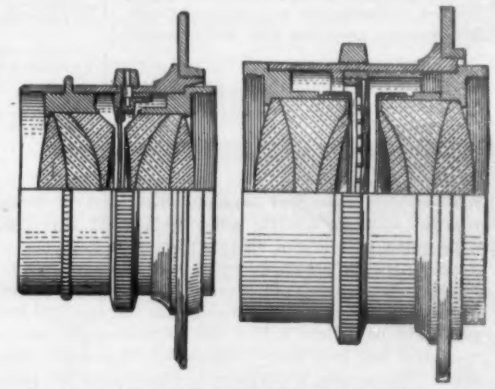


Fig. 6.—COMBINATIONS OF LENSES FOR FLAT FIELD AND ABSENCE OF COLOR.

if straight lines which intersect at right angles become lines or blurred images at the edge of the field. Still a lens might answer all the requirements for ordinary camera work but be a poor astronomical lens. A camera might cut clear to the edge of the plate on ordinary work, but when a three or four-hour exposure is given on stars all imperfections will show up. Unfortunately, for obtaining astronomical photographs a telescope mounting with a good driving clock is indispensable—which is usually out of the reach of most amateurs.

On the other hand there are a number of small visual telescopes in the hands of amateurs, and a few words might be said in regard to testing them. This is best done on a moderately bright star. Focus carefully on it. Push the eyepiece in slowly and note the change in appearance. If the spot of light does not remain circular, the objective is not "squared on" properly, or the objective may be pinched in its cell. This must be adjusted before anything more is done. Now pushing the eyepiece in, the colors should

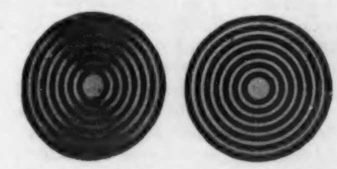


Fig. 7.—WORK OF A RECTILINEAR LENS COMPARED WITH AN ANASTIGMAT. BLURRING DUE TO ASTIGMATISM IN RECTILINEAR LENS.

change gradually and symmetrically as the disk of light enlarges. The same should hold true by pulling the eyepiece outside the focus. If the telescope behaves well from this test, turn to a double star like Castor. As the amateur becomes familiar with the heavens, he will soon learn test objects for his telescope, and if he possesses a good instrument there is no keener pleasure than trying it night after night and becoming familiar with the beauties of the heavens.

POWDER PLATING OF METALS.

Before a meeting of the Royal Society of Arts, in London last January, a paper was read on an improved method of electro-plating. It described the process of plating metals by rubbing them with a moistened powder, and a number of articles were plated with gold, silver and zinc before the society. The new plating powders are not to be confused with plating preparations which have been in use heretofore and which act merely to exchange the surface metal of the article to be plated with a thin film of deposited metal. In the new process a truly electrolytic action takes place which results in the deposit of metal without taking away the surface metal from the object to be coated. Furthermore the deposit may be made as thick as desired by continued applications of the powder. The inventor of this plating powder began his experiments a number of years ago with a view to developing a process by which knives, forks, spoons and the like can be plated as readily as they can be cleaned with polishing powders, and he succeeded in devising a method by which almost any

metal and even certain alloys such as brass in various proportions of copper and zinc can be applied to metal objects. So far the new powders are not on the market in this country, but in England they are sold in small cans for a shilling each and one can is sufficient to plate the nickeled portions of a bicycle or to plate a quantity of household silverware.

The powders are composed (1) of the metal to be deposited, in its elementary state; (2) of a salt, preferably a salt of ammonia, and (3) of a powdered metal which must be electro-positive to the metal which is to be deposited. Magnesium is the most electro-positive metal which it is commercially practical to use, and in many of the preparations this forms the active metal element. In some of the preparations, aluminium and zinc are used. The following formula gives the zinc plating powder:

Zinc	15 parts by weight
Ammonium sulphate	5 parts by weight
Magnesium	1 part by weight
Chalk	10 parts by weight
Soapstone	2.5 parts by weight

Ordinary commercial zinc dust, even though it is not perfectly pure, may be used. This same formula may be used for several other metals. If silver be substituted for the zinc in this formula, a very heavy deposit will be obtained, which will have the white frosted appearance of silver electro-plating before burnishing. If gold is substituted for the zinc, the deposit will be a light yellow, but various shades down to a rich red have been obtained by varying the formula. The article which is to be plated with the powder does not have to be cleaned before the powder is applied, for the powder itself acts as a cleaning powder and liberates the oxygen of an oxidized surface. The amateur who wishes to experiment with these powders should bear in mind that they have been patented abroad and that patents are pending in this country.

MAKING MILK ARTIFICIALLY.

BY A. J. JARMAN.

We have heard so much about the synthetic production of perfumes, syrups, dyes, and what not, from coal-tar products, that we are not easily surprised by the information that milk may be artificially made. The method described below, however, is not a chemical one, but consists merely in the mechanical admixture of distilled water with crushed and finely ground sweet almonds. Practically the only difference between cow's milk and that made of almonds is that cow's milk contains animal casein, while the artificial milk contains vegetable casein. The latter will produce a good supply of cream, and if allowed to stand some time will become sour. It may also be coagulated by the addition of vinegar or acetic acid. When combined with grape sugar, it is capable of generating some extraordinary organic substances. The artificial milk may be used with tea and coffee in the same way that cow's milk is used.

To make the milk, procure half a pound of sweet almonds—the Valencia, which is cheaper than the Jordan almond, will give just as good results. The skin of the almonds may be removed by scalding the nuts in boiling water, and peeling them with a sharp knife. The almonds should then be placed in a wooden chopping bowl and chopped as finely as possible. Take about two ounces of the chopped almonds, and place them in a mortar with a small quantity of distilled water. Then grind or levigate the chopped almonds, adding water occasionally, until about twelve ounces of water have been used. The longer the grinding is continued, the thicker and richer will the milk be. Now take a piece of cheese cloth about 12 inches wide by 24 inches long and rinse it in clean water, and after wringing it as dry as possible, fold it double over the top of a pitcher, and pour the contents of the mortar through the cloth into the pitcher. The milk may be squeezed through the cloth by wringing it gently, as shown in one of the illustrations, but care should be taken to prevent any of the larger almond particles from being forced through the meshes of the cloth.

If some of the milk thus produced is set aside for three or four hours, a thick layer of cream will be found on the surface. If too much water has been used in forming the milk, it may be necessary to add a little sugar of milk to sweeten it. The artificial milk has a slight almond flavor when taken clear, but this is practically lost when it is used with tea, coffee, or cocoa. The color of the cream produced is quite pale, but it may be improved by using some of the almonds without the skins removed in the proportion of two ounces of whole almonds to six ounces of the blanched almonds. Care must be taken to prevent any bitter almonds from finding their way into the mixture, but one or two bitter almonds to half a pound would not affect the flavor of the milk.

Half a pound of almonds will make three pints of milk.

Chopping the almonds. Grinding the almonds in water. Filtering the almond milk.

MAKING MILK ARTIFICIALLY

SOME EXTRAORDINARY DENSITIES.

BY PROF. GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

Pick up any common heavy stone, such as granite or compact limestone. Lay it at the bottom of a vessel filled with a fluid, transparent liquid. Common sense tells you that the stone will stay there. Modern chemistry tells us that, if the liquid has been selected for such a purpose, the stone will spring up to the surface as if it had been forced into mercury instead of being immersed in what seems to be water.

A COMMON HEAVY STONE FLOATING IN A GLASSFUL OF BROMOFORM.

Liquids which are denser than glass, marble, or common stones are not numerous. Leaving aside the metals mercury and gallium, and the metalloid bromine, which is opaque, caustic, and emits suffocating vapors, the most interesting of such liquids are the aqueous solutions of the tungstoborates. Their densities reach 3.3 (saturated solution of cadmium tungstoborate). An idea of the meaning of such a number can be gathered from the fact that a man, with his shoes weighted so as to lower his center of gravity, could stand erect in such a solution with more than half of his body out of it. The chemist Klein, who studied the tungstoborates, proposed to use them for the sorting of ores and other minerals, as, in most cases, useful or precious stones only will go to the bottom of their solutions. Their price however (the saturated solution of cadmium tungstoborate is sold at two cents a gramme) will for some time to come preclude such an application.

Solid aluminium remains on the surface of such liquids. To see a metal floating over a watery fluid is however no new spectacle for the chemist, several of the rarer metals being lighter than water. The cheapest of them (80 cents a pound) is sodium. The experiment should not be made with a piece larger than a corn seed, for it is sometimes attended with unexpected explosions and projections of caustic soda. As a rule, however, the metal runs swiftly and quietly over the water while decomposing it.

Sodium is the cheapest of the extremely light metals, but it is not the lightest. Lithium, a beautiful metal of a silvery white color, is lighter than dry pine wood. Yet, from the chemical standpoint, it is more metallic in its properties than the heavy osmium, which occupies the other extreme position in the list of solid elements arranged according to their increasing densities.

Such extreme differences in density are not found among liquids, yet organic chemistry gives us two colorless, transparent liquids which so differ that a vessel filled with the lighter of them, amyl hydride or pentane, and easily carried by one man, could not be lifted by four men when filled with bromoform. The density of pentane is 0.6, that of bromoform, 2.9. Both liquids are apparently more fluid than water, and it is always amusing to watch the countenance of the unaware person who is requested to remove a glass full of bromoform from one place to another. Bromoform is sometimes prescribed by physicians against whooping cough. It is found at every drug store and costs but $1.75 a pound.

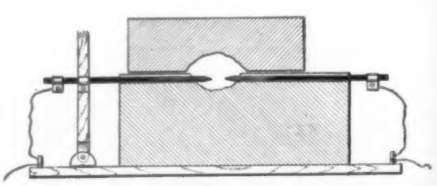
But it is with gases that the greatest divergences in density occur. Iodoform vapor, which causes the intense stench of that well-known antiseptic, is 197 times heavier than hydrogen. When some iodoform is vaporized in a porcelain dish placed over an alcohol or gas lamp, it is partially decomposed. Iodine vapor is set free, and remains mixed with iodoform vapor. As iodine vapor is itself one of the heaviest of gases, the experiment remains very beautiful. If the air is quiet, a lateral jerk given to the dish causes the layer of violet gas to oscillate heavily, just as a liquid would do in similar circumstances.

A SMALL ELECTRIC FURNACE.

BY A. E. PARKINS.

The accompanying cut shows the cross section of a small electric furnace made from a description of the Moissan furnace. In this one the brick and lime cavity are replaced by a block of limestone about 5 x 5 x 9 inches. In the top face of the base is hewn a cavity about 1 x 1 x 2 inches, also two longitudinal grooves to receive the carbon electrodes.

The cover is a similar stone with a cavity hewn in its lower face. Both base and cover should be bound with a piece of sheet iron or tin to keep the pieces in place should the heat be great enough to crack the stones. The carbons are regulated by means of the vertical lever, hinged at the base and attached to the carbon by means of a clamp. This clamp is attached to the lever at one place only. This allows sufficient horizontal movement. The electrodes are connected to a lantern circuit (alternating current 212 volts) by means of clamps. These clamps and other metal work are made from sheet aluminium—easy to cut and easy to shape. The bolts used are short stove bolts.



A SMALL ELECTRIC FURNACE.

In such a contrivance calcium carbide, calcium phosphate, phosphorus, brass, and alloys are easily prepared.

Calcium carbide requires intense heat; the cavity should be small. Gas carbon or powdered arc light carbon is best to use.

Calcium phosphide is prepared by heating calcium oxide, carbon, and red phosphorus. The phosphorus is placed in first, in small quantities; this is covered by the other ingredients, well mixed and pulverized. Some kinds of animal charcoal and calcium oxide will produce calcium phosphide.

Phosphorus is prepared as directed in Newell by heating a phosphate, charcoal, and sand. Phosphorus is separated and burns at the top. It sometimes sublimes on the faces of the stones and bursts into flame when the cover is lifted. The glass-like slag remains in the furnace. This is exceedingly hot. Pieces of porcelain are easily melted when pushed into this plastic mass.

Brass is easily made by heating zinc and copper. The stones may be obtained from the refuse heap at a stone cutter's. The corner of an old ax will prove a good instrument for cutting the grooves and cavities.—School Science and Mathematics.

NEW BOOKS, ETC.

THE SCIENTIFIC AMERICAN HAND BOOK OF TRAVEL. With Hints for the Ocean Voyage, for European Tours, and a Practical Guide to London and Paris. Compiled and Edited by Albert A. Hopkins, Editor of the SCIENTIFIC AMERICAN Reference Book. New York: Munn & Co., Inc., 1910. 12mo.; 500 pp.; 500 illustrations. Price, $2 net in flexible cloth; full leather, $2.50 net.

There are no conditions of travel in which a few general hints as to how to adjust one's affairs can prove so useful as on a sea voyage, and it is with the object of preparing the traveler for his trip by telling him how to go, how much it will cost, how to amuse himself, and what to do when arriving at the coveted shore, that this book has been written. It is the result of twenty years' investigation and travel on the part of the Editor, who is a member of the staff of the SCIENTIFIC AMERICAN. The work contains six color plates and an elaborate set of maps in a pocket in the back of the book, including an excellent itinerary map of Europe published by the Automobile Club of America. The maps of London and Paris are on a new plan. The illustrations were selected from over 5,000 which were placed at the disposal of the Editor, and many of the scenes on shipboard have never before been reproduced. The book is of a convenient size to be carried in the pocket and is a handsome piece of book making. The writer gives the kind of information which he himself and others of his acquaintance have wanted to know on various transatlantic voyages. Much of the material presented is in so readable a form that pages can be read by the score, which is something unusual in a guide book or similar book of reference. Thus it tells how the circuit of the earth can be made in thirty-eight days, instead of the proverbial eighty days of Jules Verne; it tells how it is possible to leave New York Wednesday morning and reach London Monday night and Paris Tuesday morning. The book is so extensive that it is impossible to do more than call attention to a few of the salient features. The question of time is admirably dealt with, and the elucidation of the twenty-four-hour clocks used in Berlin, Italy, and Spain is of particular value. The traveler's vocabulary in four languages precludes the necessity of the purchase of special books on the subject, as does also the cable code. The question of expenses is dealt with in detail, while the much-vexed question of baggage is considered at some length. Various ocean fares are given, as well as information as to how to carry money. The sizes of foreign coins are given by means of diagrams, which will prevent much confusion in the minds of those who use foreign coins for the first time. The list of articles not to be forgotten is one of the interesting features of the book. The section relating to telegraphs and cables is absolutely complete, and is indorsed by the officials of all the leading telegraph and cable companies. "The Voyage" is dealt with in detail from the time of coming on board until the landing on the foreign shore. The smallest thing which can help, interest, or amuse the traveler will be found in the proper place; thus, for the concerts there is given "America," "Star-Spangled Banner," "God Save the King," "Rule Britannia," "Marseillaise," and the "Watch on the Rhine," which are all of the national anthems of four countries that are usually played. The question of seasickness is the subject of some three pages, and the best and most successful remedies are given. The technical portion relating to the ship deals with everything from the keel to the lookout, and is accompanied by interesting engravings, many of which were made specially for the book. The section on "Ocean and Navigation" deals with the work of the officers and describes the many interesting things which are met with, such as icebergs, whales, etc., and the amount of nautical lore conveyed is considerable. Everything relating to signals is presented. The section relative to statistical information offered peculiar difficulties which have been surmounted in a masterly manner. Thus the list of transatlantic passenger steamers is given which sail not only from New York, but from such minor ports as Galveston. There are maps of all the harbors in the United States from which steamers arrive and depart for both Europe and Asia. The railroads of the world, distances in nautical miles between ports and lights are also given. The section devoted to "The Arrival" is a highly important one, dealing with all of the principal terminal ports and ports of call. The book even tells the visitor how to get to Hoboken. The section relating to "Railways" gives much-needed information which cannot be obtained elsewhere in the English language. The part of the book devoted to Tours occupies thirty-five pages, and gives 400 tours with prices. There is also a list of 2,000 hotels and their rates, and a most valuable chapter on automobiling in Europe, which has been unqualifiedly indorsed by the leading automobile clubs and associations. The Guide to London was written by the English correspondent of the SCIENTIFIC AMERICAN, Mr. F. A. A. Talbot, who is well known to our readers, and is without exception the most up-to-date guide to the great British metropolis. The practical guide to Paris is also valuable when taken in connection with the unique maps. Those who are not thinking of taking a European trip will find the book of the utmost value as a work of reference.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRIC VENTILATOR.—W. MEHLHOSE, Charlottenburg, Germany. The invention relates to a ventilator consisting of an electromotor and two fans, one of which is fastened on the armature shaft of the electromotor, while the other fan is mounted on a suspended support to turn around a vertical axis and is adapted to carry within its bell-shaped nave the casing of the electromotor.

TRICK ELECTRIC POCKET-LAMP.—A. JEDEL, New York, N. Y. More particularly this invention relates to that type of apparatus in which a movable part may be unexpectedly released during the handling or manipulating of the device. One object is to construct the device so that it will have the exact appearance of a pocket electric light with the battery casing, light bulb and switch or push button.

Of Interest to Farmers.

ADJUSTABLE COMB FOR GRAIN-STRIPPING MACHINES.—E. A. A. PAVY, North Parade, Jamestown, South Australia, Australia. The comb is for use with strippers and stripper harvesting machines in which the adjustment is made by increasing or decreasing the width of the individual teeth. The purpose of the inventor is to enable the comb to be quickly adjusted to take a heavy or a light crop and also to enable a choke to be easily and quickly cleared.

BALE-TIE MACHINE.—J. A. SCHARF, Richwood, Ohio. An object of this improvement is to form a machine which will perform the various operations of drawing out, bending, twisting, stretching, cutting and removing the bale-ties from the machine, with a small amount of power and with the least attention from the operator.

Of General Interest.

ABDOMINAL RETRACTOR.—J. E. SPARKS, Crossett, Ark. The invention pertains more especially to abdominal retractors, although with suitable modifications the instrument may present a speculum for the parts, a rectal speculum or mouth gag; in any case, the feature of adjustment and automatic locking of the spreading arms being substantially the same.

GOPHER-TRAP.—A. F. RENKEN, Kramer, Neb. This invention refers to means for killing the pocket gopher, a type of field rat that closes the mouth of its burrow with earth that it pushes in front after a burrow is extended and widened sufficiently to permit the animal to turn around. This trap is adapted to kill this rodent by taking advantage of its peculiar habits.

Heating and Lighting.

COMBINED GAS AND ELECTRIC FIXTURE.—A. I. SCHWINGER, New York, N. Y. This fixture is in the form of a highly ornamental chain, having a continuous channel for the passage of the gas and an interrupted passage for the electric wires, to permit of conveniently threading the electric wires in the links of the chain and to give access to the wires at any time for repairs or other purposes.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending April 19, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid baths, apparatus for preparation of carbonic, J. Michal 955,182
Aeroplane, L. R. Culver 955,389
Air brake, C. W. Frye 955,788
Air brake controlling means for locomotive engines, S. N. Stevens 955,611
Air brake system, A. J. Wisner 955,625
Air compressor, automatic, J. Rogers 955,437
Air compressor, hydraulic, P. Bernstein 955,124
Alarm. See Fire alarm.
Alternator, exciting, C. H. Kicklighter 955,171
Amalgamating apparatus, Montgomery & Welthas 955,604
Amusement device, F. Jackson 955,407
Anti-induction device, M. M. Davis 955,141
Antiskiding device, N. Barnett 955,306
Auger, A. H. Howland 955,803
Automobile fender, D. J. Welton 955,624
Axle, vehicle, C. Criess 955,251
Bag fastener, H. Vanderwerp 955,232
Balancing device, R. R. Reed 955,435
Balls, making hollow metallic, J. W. Schatz 955,698
Basket, T. C. Nelson 955,824
Bearing ball, A. Riebe 955,286
Bearing roller, W. J. Brewer 955,128
Bed or seat, spring, I. E. Palmer 955,350
Bell, electrical signal, H. W. Eden 955,636
Belt, link, W. C. Brisse 955,377
Bifurcating machine, R. L. Wilcox 955,373
Binder, loose leaf, C. L. Bartling 955,307
Boat, hydroplane, W. M. & L. E. Meacham 955,343
Bobbins or spools, holders for, T. F. Rooney 955,208
Boiler tube cleaner, E. I. K. Noyes 955,348
Boiler tubes, leak stopper for, C. S. Clark .. 955,500
Bolster spring, H. J. Noll 955,673
Boring bar, R. J. Mason 955,180
Bottle, W. P. Bebler 955,309
Bottle and stopper therefor, W. Douglas ... 955,772
Bottle cap, A. Calleson 955,380
Bottle ends with tin foil, machine for closing, T. K. Keith 955,270
Bottle stopper, water, Schweinert & Kraft. 955,441
Bottles and vessels, cap for, A. G. Kent ... 955,808
Bottling machine, S. Reinsberg 955,551
Box. See Mail box.
Box blank making machine, E. C. Staude .. 955,713
Brake beam, C. H. Williams, Jr. ...955,239, 955,240
Brake beam, S. U. Walck 955,620
Brooder, H. A. Nourse 955,473
Brush holder, paint, C. H. Jorey 955,646
Brushes, bristle rim for rotary, I. Abrahmsohn 955,738
Building blocks and wall, H. Van Caeyseele 955,230
Butter tester, C. Wagner 955,725
Cabinet, kitchen, J. M. Bainer 955,746
Cabinet, medicine, C. Beifi 955,312
Cable clip, F. D. Ogden 955,539
Cable hauling engine, O. Potter 955,283
Camping apparatus, G. E. Cronk 955,140
Can feeding and delivering mechanism, J. W. White 955,731
Candy cooler, G. F. Dickson 955,771
Car brake operating mechanism, W. D. Brewster 955,450
Car, convertible stock, A. Westphal 955,238
Car door, H. A. Christy 955,381
Car door, A. R. Bulloch 955,755
Car door, C. Buss 955,757
Car door supporting and operating means, flush, D. F. Noll 955,537
Car doors, weather and cinder strip for box, J. M. Jordan 955,516
Car, dumping railway, J. V. Ericson 955,452
Car fender, L. Fabian 955,147
Car fender, C. A. Bisbee 955,495
Car replacer, F. J. Wood 955,375
Car roof framework, E. Posson 955,544
Car safety brake, W. E. Nolan 955,536
Car step, extension, Mitchell & Campbell ... 955,658
Car ventilator, E. Posson 955,543
Car wheel and propelling parts co-operating therewith, double safety, L. Clark 955,382
Car window, L. J. Berg 955,123
Cars, electric signaling device for motor, J. L. Palous 955,192
Cars, life guard for railway, G. A. Parmenter 955,678
Cars, means for locking drop doors of dump, R. G. Taylor 955,225
Carbureter, J. W. Smith 955,218
Carbureter, A. E. Stoker 955,222
Carbureter, F. W. Sickles et al. 955,292
Carbureter, W. R. Park 955,353
Carriage, house moving, D. Stout 955,223
Carriage top, G. W. Hedrick 955,512
Carrier. See Die carrier.
Cartridge, C. O. Person 955,680
Cash register system, P. G. Warnock 955,621
Caskets, etc., fastening device for burial, J. S. Muckle 955,665
Caster, E. H. Humphrey 955,162
Cellar, storm and refrigerator, O. K. Harry 955,794
Centrifugal separator, Preston & Duffie 955,355
Chuck, drill, N. Drew 955,326
Churn dasher, E. A. Franklin 955,394
Cigarette tipping machine, individual, A. Boucher, reissue 13,105
Circuit closer, H. H. Cutler 955,323
Clip cap, J. W. Kessel 955,517
Clock, master, M. W. Obermiller 955,538
Closet ventilating and flushing apparatus, E. E. Lauphear 955,518
Cloth holder, B. A. Spinney 955,219
Clothes drier, F. E. Bird 955,576
Clothes line clip, W. M. Fridall 955,257
Clothes rack, M. Redlinger 955,434
Coal and ore crusher, J. F. Sauerman 955,555
Coal dust, coal slack, and the like, semicoking, C. W. Beehler 955,310
Coat facing, E. Reisman 955,690
Coating metal objects, B. Hemann 955,592
Cock, stop and waste, W. H. Dehn 955,770
Coffee roaster, A. E. Tava 955,616
Coin operated key lock, C. E. Guthrie et al. 955,792
Collapsible tube, W. S. Morrison 955,530
Collar, coat, M. Koppelman, reissue 13,104
Combing machines, construction of and means for actuating the dabbers of wool, Boys & Tierney 955,752
Composing stick, S. A. Neidich 955,534
Composition of matter, Schmitt & Bell 955,362
Compressor, J. D. Mayhew 955,822
Concentrator, reciprocating multiple compartment, G. A. Fowler 955,329
Concrete building, W. S. Laney 955,507
Concrete construction, reinforced, E. P. Wells 955,236
Concrete curbs or gutters, form for laying, M. S. Hotchkiss 955,801
Concrete fence, reinforced, C. Mitchell 955,528
Concrete headstone, W. R. Thomas 955,720
Concrete mold, adjustable, H. Pocock 955,232
Concrete railway tie, W. H. Pruyn, Jr. 955,547
Concrete sidewalk form, Ramey & Chilcote. 955,474
Concrete structural work, form for, M. S. Hotchkiss 955,800
Concrete tie, reinforced, C. R. Holden 955,645
Condenser and mold for carbon dioxid, W. J. Flemming 955,454
Cooker, fireless, J. Winter 955,733
Cooler. See Candy cooler.
Cooling apparatus, G. W. & H. A. Wise ... 955,242
Core, collapsible, S. A. Wellman 955,235
Corn husking and shredding machines, discharge spout for, A. Rosenthal 955,357
Cotton chopper or cultivator, M. C. Burch .. 955,756
Cotton folder, F. Phelps 955,542
Course indicator, H. H. Nebanas 955,347
Crayon holder, G. A. Tucker 955,617
Cue tipping machine, G. Mahoney 955,819
Cuff protector, N. Cerri 955,631
Cultivator, lister, W. S. Graham 955,510
Culverts, collapsible and adjustable mold for cement, G. W. Fish 955,779
Currycomb attachment, N. H. Burns 955,579
Curtain pole, B. F. Randolph 955,607
Curtain roller, E. Renkauf, Sr. 955,691
Cushion, F. P. D'Arcy 955,324
Cutting-off tool, L. J. Matzner 955,466
Cylinder press, E. P. King 955,647
Dado machine, P. L. Billingsley 955,749
Decoy duck, J. W. Reynolds 955,203
Dental engine, electric, J. V. Trenaman ... 955,484
Dental lavatory, T. Dunbar 955,143
Dentimeter, A. D. Cloud 955,320
Desk and seat, school, A. R. Milner 955,184
Desk support, school, W. A. Proctor 955,546
Die carrier, H. Zimmerman 955,245
Disk marker, C. H. Myers, reissue 13,102
Display box fronts, fastener for, A. F. Urban 955,563
Display device, L. G. Quackenboss 955,200
Display rack, J. Wolkerstorfer 955,734
Display rack, mattress, L. Emerich 955,586
Display rack or stand, J. D. Fassio 955,589
Distilling column, E. Bolton 955,127
Door and mechanism for operating the same, automatic, J. & J. Parkhill 955,540
Door for cold storage rooms, Plotron & Hamilton 955,782
Door guide, Crosby & McGooden 955,502
Door opening and closing device, T. M. Blackwell 955,125
Doors from sagging, device for preventing, P. E. Nordquist 955,674
Doors of hatches, means for operating, J. T. Taylor 955,961
Draft concentrator, P. J. Mooney 955,605
Draft mechanism, L. J. Jackson 955,805
Drainage plugs, operating mechanism for, H. J. Geurink 955,456
Drawer pull, S. R. Cartledge 955,760
Drawing press, W. Klocke 955,173
Drier. See Clothes drier.
Drill socket, F. Maier 955,650
Drumhead tightener, E. M. Yates 955,736
Dye, thioindigo vat, Schmidt & Thiess 955,699
Ear plug for bathers, J. Lopisich 955,276
Egg beater, Nielsen & Imirie 955,672
Eggs, preserving, H. J. & S. C. Keith, Jr. .. 955,835
Elastic wheel, J. C. MacLachlan 955,417
Electric currents, apparatus for transmitting and utilizing, P. C. Hewitt 955,459
Electric currents, transmitting and utilizing, P. C. Hewitt 955,460
Electric furnace, Meyer & Stillesen 955,655
Electric machine, G. O. Holmgren 955,268
Electric terminal clip, W. Barcy 955,747
Electrical conductor for illuminating purposes, I. Ladoff 955,273
Electrical conductors, device for preventing induction in, M. M. Davis 955,142
Electrical distributing board, H. J. Blakeslee 955,126
Electrical distribution, system of, J. L. Woodbridge 955,447
Electrical heater, R. Lares 955,598
Electrical receptacle, screw plug, F. J. Russell 955,438
Elevator safety device, C. J. Brookins 955,451
Elevator system, electrohydraulic, R. M. Fraser 955,508
Embroidery hoop, N. C. Leonard 955,415
Engines, current controlling mechanism for internal combustion, L. T. Rhoades 955,204
Engines, frame construction for gas, J. A. Charter 955,632
Engines, speed regulator and timer for explosive, J. F. Murphy 955,667
Excavating shovel, C. J. Reise 955,285
Exercising machine, electrical muscular, W. Harris 955,793
Extinguishing burning benzine, etc., M. Breslauer 955,316
Fan, mechanical, L. Meszaros 955,823
Fan, oscillating, A. Rubin 955,209
Fastener, J. W. McKitrick 955,186
Faucet, W. H. Kilbourn 955,272
Faucet, H. Mueller 955,531
Faucet, J. Gielow 955,641
Feed bag for horses, C. W. Millsaps 955,183
Feeder, poultry, E. R. Donaldson 955,503
Fence clamp, wire, J. W. Davis 955,254
Fencing, machine for reeling and cutting off wire, J. M. Denning 955,584
Fertilizer distributer, C. C. Butler. .955,132, 955,133
Fertilizer distributer, C. H. Pelton 955,354
Filaments for incandescent lamps, manufacturing, J. W. Howell 955,461
Filter, G. Moore 955,660
Filter, F. D. Freeman 955,787
Filtering process, G. Moore 955,836
Fire alarm, J. H. Hayes 955,798
Firearm, C. A. Young 955,490
Fire escape, G. R. Witt 955,243
Fireproofing compound, S. Gousseff 955,262
Fishing line reel and holder, W. F. Simons. 955,366
Floor joist and ceiling, combination, A. F. Leiter 955,338
Floor scraper, W. F. Stern 955,444
Flower pot and jacket for the same, G. Hershkovitz 955,644
Flue blower, F. Shmonsky 955,706
Folding table, S. Hyde 955,804
Follower-wheel, composite, H. H. Tunis 955,227
Forging press, T. F. Baily 955,122
Frames, attachment for testing or treating, H. C. Hill 955,333
Freezing, apparatus for concentrating solutions by, E. Monti 955,659
Fryer, doughnut, B. W. Forgue 955,507
Funnel, L. N. Ritten 955,553
Furnace. See Electric furnace.
Furnace, L. B. Piper 955,199
Furnace, H. A. MacClyment 955,340
Furnace, W. G. Crosthwaite 955,387
Furnaces, hot blast for boiler, P. H. Bagley 955,573
Gage. See Rule gage.
Gage, W. A. Lomax 955,175
Garment closer, O. Eisenkramer 955,637
Garment supporter, H. C. Hine 955,837
Gas burner, C. L. Bean 955,308
Gas cleaner, P. Meehan 955,651
Gas generating apparatus, H. H. Eason 955,585
Gas producer, Stone & Dodd 955,614, 955,615
Gear fastening device, F. Meyer 955,656
Gear mechanism, reciprocating, W. L. Hamilton 955,331
Gearing, G. B. Pilkington 955,198
Gearing, S. Lippert 955,816
Gearing, automobile transmission, R. E. Wynn 955,244
Gearing, lock for, G. O. Leopold 955,815
Gearing, power, W. H. Hampton 955,815
Gearing, reversing, W. Struck 955,717
Gearing, variable speed, F. Weiker 955,488
Glove, boxing, S. Cline 955,136
Go-cart, folding, Folgeman & Kraus 955,783
Grain feeding or discharging apparatus, E. Morean 955,606
Grass catcher, F. Wetteroth ......955,565 to 955,567
Grate, adjustable basket, J. F. James 955,269
Grinder, swinging, M. F. Apgar 955,626
Grinding or polishing machine, E. Rivett ... 955,206
Gun, G. B. Reid 955,436
Gun attachment, G. P. Riggs 955,694
Guns having differential recoil, retarding apparatus for, K. Haussner. 955,795, 955,796, 955,797
Guns, single trigger mechanism for double-barrel, F. C. Lefler 955,275
Hair waver, A. Keroff 955,271
Hame hook, J. Q. Ormsby 955,427
Hames fastening device, J. W. Gonce 955,152
Hammer, H. Malsch 955,524
Hammer, electric, C. C. Lutes 955,522
Hammer, pneumatic, R. W. Raikes 955,686
Hammer, power, W. H. Welch 955,623
Hammer support, pneumatic, H. M. Jacobs. 955,166
Hammock canopy, folding, E. R. Norwood .. 955,281
Hammock, framed or couch, I. E. Palmer .. 955,826
Hammocks, etc., resilient bottom for couch, I. E. Palmer 955,351, 955,352
Handle shaping machine, G. Fletcher 955,639
Hanger. See Harness hanger.
Hanger arm, Laughlin & Schuyler 955,599
Harness hanger, J. W. Stake 955,710
Harness spreader, C. H. Anderson 955,741
Harrow, C. G. Johnerson 955,515
Harvester, G. A. Tuttle 955,229
Harvester, cotton, O. C. Houghton 955,594
Harvester, grain, Burger & Gominsky 955,249
Harvester, pea, G. E. Pritchard 955,684
Hat fastener, S. Raymond 955,433
Hat fastener, L. Metzdorf 955,654
Hay rake and loader, side delivery, M. H. Madsen 955,176
Heel, spring, E. A. C. Schoof 955,700
Hinge, spring, M. Merriman 955,653
Hog catching machine, G. W. Cox 955,139

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

MUNN & CO., Inc.

BUSINESS OPPORTUNITIES.

WANTED. Canadian manufacturer to manufacture the Ken-get-er Sleigh-Runner, can be attached to all kinds of go-carts and baby carriages, on royalty basis. For further information address Kengeter, 3656 Pitkin Avenue, Brooklyn, N. Y.

Inquiry No. 8918.—For manufacturers of "Wydt's Electro-Catalytic Sparking Plug."

PATENTS FOR SALE.

FOR SALE.—A German patent on dough cutting and moulding machine. For further particulars address Otto Richter, Franklin Avenue, Salem, Ohio.

Inquiry No. 8987.—Wanted, the manufacturers of the Van Winkle Woods & Sons, and the Weber power meters.

FOR SALE.

FOR SALE.—Models and molds for everything in plaster, iron and bronze. Ceiling outfits, drophammers and dies. Acorn Works, Indianapolis, Ind.

Inquiry No. 9014.—For manufacturers of machinery, supplies, etc., to equip a small plant for the manufacture of iridium-tipped gold nib making for fountain pens.

LISTS OF MANUFACTURERS.

COMPLETE LISTS of manufacturers in all lines supplied at short notice at moderate rates. Small and special lists compiled to order at various prices. Estimates should be obtained in advance. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9016.—Wanted, machinery necessary for an installation of a plant for refining salt by a modification of the Bessemer process.

HELP WANTED.

WANTED.—A high class superintendent on track revision work, raising and lowering grades. Only those with experience need apply. Experience, Box 773, N. Y.

SALE AND EXCHANGE.

FOR SALE.—Engine lathe. Our regular $75.00 lathe complete, with a face plate, two centers, wrenches and a full set of change gears to cut all size threads. Price only $43.50. L. F. Grammes & Sons, Allentown, Pa.

Inquiry No. 9023.—Wanted, to buy silk machines from re-reeling, twisting, doubling, to the final process of making it into clothes.

A LIST OF 1,500 mining and consulting engineers on cards. A very valuable list for circularizing, etc. Price $15.00. Address Munn & Co., Inc., List Department, Box 773, New York.

Inquiry No. 9029.—Wanted, catalogues and all information on machinery for braiding straw in manufacturing straw hats.

Inquiry No. 9038.—Wanted, the address of the Chipman Electric Purifying Co.

Inquiry No. 9042.—Wanted the address of Farney Safety Razor Co.

Inquiry No. 9053.—Wanted, address of firms who install plants to manufacture nitrogen.

Inquiry No. 9055.—Wanted, address of parties interested in Log Cleaning Machines.

Inquiry No. 9060.—Wanted to buy machinery to manufacture seed corn racks.

Inquiry No. 9066.—Wanted complete outfit for export for making rice-flakes and wheat-flakes.

Inquiry No. 9073.—Wanted, machinery to manufacture cocoanut oil; also the crude material.

Inquiry No. 9074.—Wanted, to buy old model locomotives or steamboats, such as were exhibited with nickel-in-the-slot attachments in ferry-houses, etc.

Inquiry No. 9075.—Wanted, to buy small weather vanes, such as can be used as ornaments on lightning rod tops. Aluminum preferred.

Inquiry No. 9076.—Wanted, the address of parties in Canada who could make a safety razor.

Inquiry No. 9077.—Wanted, the address of manufacturers that make small articles of wood, such as checker boards, etc.

Inquiry No. 9078.—Wanted, the address of manufacturers of sewer pipe, made of fiber and asphaltum, suitable for laboratory use.

Inquiry No. 9080.—Wanted the address of parties manufacturing paste-making machinery.

Inquiry No. 9083.—Wanted, the address of firms manufacturing small beer brewing plants, from 75 to 100 gallons a day.

Inquiry No. 9085.—Wanted, to buy longitudinal hollow perforated tubing.

Inquiry No. 9086.—Wanted, to buy a pine wood peeler.

Inquiry No. 9090.—Wanted manufacturers of suspender and supporters supplies, also patent adjustable bachelor buttons.

Inquiry No. 9092.—Wanted, the address of some firms who manufacture permanent lamp wicks.

Inquiry No. 9094.—Wanted address of The Thomas Arithometer Company, also Burkhart Arithometer Company.

Inquiry No. 9095.—Wanted, name and address of the manufacturer of the duplex revolving pencil sharpener.

Inquiry No. 9096.—Wanted, the address of manufacturers of spiral welded pipes, possessing great strength.

Inquiry No. 9097.—Wanted, address of makers of impulse water wheels.

Inquiry No. 9098.—Wanted, name and address of the manufacturers of the ozonizer.

Inquiry No. 9099.—Wanted, address of manufacturers of machinery for making wire cables.

Inquiry No. 9101.—Wanted, addresses of manufacturers of a dip or magnetic needle, for exploring for iron ore.

Inquiry No. 9104.—Wanted, addresses of manufacturers under the name of A. D. Co. Standard.

Inquiry No. 9107.—Wanted, addresses of manufacturers of small emery files (pieces of emery in the shape of a file).

Inquiry No. 9109.—Wanted addresses of the manufacturers of the Dion Desk Clock.

Inquiry No. 9110.—Wanted to buy machinery for reducing old tin cans, so that they may become a source of revenue.

Hoisting and conveying apparatus, F. N. Wedge 955,832
Hoof paring machine, E. Cronin 955,252
Horse overshoe, B. Clow 955,765
Horseshoe calk, W. E. Abbott 955,246
Hose bridge, A. J. Neff 955,280
Hose supporter, garden, A. Getman 955,260
Hosiery, clamp for holding forms or stretchers for, A. C. Beck 955,627
Hotel indicator, R. G. Zahaian 955,491
Ice machine, gang saw, G. H. Babcock 955,744
Incandescent mantles, means for packing, H. Schmalland 955,361
Index, R. W. Wood 955,735
Indicator, W. D. Stanton 955,712
Ink well, J. B. Randolph 955,432
Inking device, B. von Philp 955,197
Insulator, W. E. Moore 955,661
Internal combustion engine, E. T. Gilliard 955,151
Internal combustion engine, T. Cooper 955,767
Internal combustion engine, O. E. Frear 955,786
Internal combustion engine, two-stroke-cycle, G. Enderby 955,144
Ironing board, B. W. Ross 955,554
Ironing table, J. W. Miller 955,526
Jacquard, L. L. F. Malhere 955,177
Jacquard machine, T. M. Morrow 955,664
Jar holder, fruit, E. A. Vandenburgh 955,231
Journal bearing, J. L. Boyer et al 955,248
Journal boxes on railway trains, apparatus for cooling, W. P. Andrews 955,743
Kinematograph films, mechanism for the feeding of, O. Messter 955,840
Kinematograph apparatus, Muller & Rousset 955,666
Kinetoscope, A. C. Roebuck 955,477
Knitted fabric, R. W. Scott 955,702
Knotter, H. D. Colman 955,384
Ladle stopper, metal pouring, J. E. Sheaffer 955,704
Lamp, automobile, E. E. Allen 955,493
Lamp extinguishing burner, F. H. Conner 955,138
Lamp, gas, A. Rector 955,540
Lamp, hydrocarbon incandescent, P. Q. Wray 955,571
Lamp mounts, machine for forming incandescent, E. Simon 955,442
Lamp safety device, electric, C. W. Eisenmann 955,777
Lamp, sectional incandescent, Bill & Redman, Sr 955,748
Lamps, mantle burner for kerosene, H. E. Rider 955,829
Lathe dog, W. L. Reid 955,688
Lathes, gear cutting attachment for, J. M. Campbell 955,498
Lathes, relieving attachment for, B. M. W. Hanson 955,643
Lavatory apparatus, valve mechanism for, J. Allingham 955,740
Lead pigment, manufacture of white sulfate of, Hanney & Wilson 955,396
Leaf holder, loose, J. R. Haldeman 955,330
Leather or the like, machine for cutting, skiving, and splitting, P. Heidmann 955,266
Leather punching machine, C. P. Stanton 955,711
Ledger with visible index, E. Kellner 955,807
Level, combination, M. F. Holbrook 955,799
Lifter, E. B. Topp 955,722
Lifts, air distributing nozzle for air, G. L. Joss 955,409
Lime, hydrating, L. T. Leet 955,814
Line casting machine, J. R. Rogers 955,695
Line casting machine, justifier for, R. G. Clark 955,764
Link, repair, S. E. Oneal 955,426
Lineotype machine, H. Plant 955,681
Liquid fuel burner, Stokes & Vickers 955,715
Lock and latch, combined, C. M. Drury 955,774
Lock for prepayment meters and similar devices, Newman & Ferrick 955,825
Lock operating device, W. A. Hill 955,267
Locking key, selective, J. F. Cadell 955,134
Locking switch, safety, D. A. Beezley 955,311
Log retainer, Drever & Kellaher 955,773
Loom dobby, W. H. Selley 955,559
Loom for weaving textile fabrics, power, L. E. Salisbury 955,211
Loom harness holding device, W. G. Shull 955,365
Loom picker spindle lubricator, T. & E. G. Ashworth 955,572
Loom shuttle, C. Rafferty 955,548
Loom shuttle, Cunniff & Rafferty 955,583
Loom weft stop motion means, L. E. Salisbury 955,212
Looms, tension device for take-up rolls of, J. Smith 955,600
Looms, thread cutting mechanism for, A. J. Chevrette 955,581
Lubricator. See Loom picker spindle lubricator.
Lubricator, A. Miltz 955,420
Lubricator, M. G. Melvin 955,652
Lung tester and detonating device, C. B. Post 955,682
Mail bag catching and delivering apparatus, G. W. Saylor 955,697
Mail box, G. Westelin 955,730
Mailing galley, R. E. Zeiske 955,303
Mask, anesthesia, V. F. Marshall 955,821
Mask, chin, G. W. Thomas 955,562
Massage device, J. C. Lumsden 955,339
Match scratching device, W. V. Hardy 955,397
Measuring device, J. Lazarus 955,519
Measuring device, S. Therrien 955,719
Metal bars, machine for slitting and flanging, A. Priddle 955,431
Metal plating, L. M. Willey 955,446
Metal reducing machine, B. M. W. Hanson 955,642
Metal slitting machine, H. K. Dyson 955,776
Milking device, E. Stene 955,610
Milking machinery, Wiggins & Bristow 955,732
Miter box, G. W. Fish 955,149
Moistening machine, A. N. Southwick 955,708
Mold for making culverts, conduits, and similar hollow structures, J. Hickson 955,156
Molding machine, H. Ripplinger 955,356
Molding machine, J. Allenson 955,838
Monotype machine, C. K. Rieck 955,839
Mortising machine, Faust & Hogland 955,834
Motor controller, electric, W. M. Connelly 955,137
Motor switch, electric, H. C. Grant 955,154
Motors, electric ignition system for explosion, R. Varley 955,618
Motors, means for starting alternating current, W. J. Foster 955,455
Mower attachment, lawn, S. W. Gooding 955,261
Music rolls, adjusting device for, C. Flettner 955,506
Nails and the like, machine for forming enlarged or extended heads upon, Davies & Bell 955,635
New purin bases, M. Engelmann 955,587
Nozzle deflector, W. C. Stone 955,294
Numbering machine, W. F. C. Foster 955,785
Nut lock, R. A. Bradshaw 955,577
Nut lock, G. J. Forrey 955,784
Nut lock, R. J. Gray 955,791
Oil burner, Walling & Olson 955,727
Oil feed for journals, adjustable, H. G. Short 955,608
Oilstone holder, Hayne & Pike 955,265
Ores bearing precious metals, treatment of, J. C. Clancy 955,318, 955,319
Outlet box, N. Marshall 955,820
Oven, baker's, C. H. R. Joern 955,514
Oven plate, F. V. Knauss 955,411
Ozonizer, A. Lohman 955,818
Package carriers, safety locking mechanism for, L. B. Bethards 955,628
Packing ring, W. T. Mills 955,527
Packing, rod, A. D. Morris 955,662
Packing, shaft, G. C. Hicks, Jr 955,332
Painting machine, H. Mikorey 955,344
Pan. See Vacuum pan.
Paper bag, M. Vierengel 955,564
Paper working machinery, fault detecting and corrective apparatus for, C. B. Stilwell 955,221
Pasteurizer, C. Skidd 955,481
Pea huller, J. R. Hughey 955,403
Pen and pencil clip, J. H. Pilkington 955,430
Pen and penholder, D. Nagy 955,670
Pen caps, tool for applying clips to fountain, M. R. Crossman 955,386
Pen, fountain, F. Reisenberg 955,205
Pen, fountain, B. Rentz 955,475
Pen, fountain, E. E. Morlan 955,675
Pens, apparatus for filling fountain, P. J. Sullivan 955,830
Pencil box, E. I. Hawk 955,399
Pencil, lead and crayon, J. Soss 955,293
Pencil sharpened, W. F. Herdich 955,513

Petroleum, distillates, desulfurizing, H. V. Walker 955,372
Phonograph, H. T. Oliver 955,424
Photographic plates, films, and the like, daylight developing apparatus for, E. H. Smart 955,445
Picture machine, moving, L. Nesemann 955,189
Pile, L. E. Welsh 955,729
Pin, Fischer & Pruefer 955,453
Pin spotter, Lewis & Farrow, Jr 955,416
Pipe coupling, J. R. Morris 955,663
Pipe coupling, M. F. Richardson 955,828
Pipe making apparatus, J. R. McWane 955,423
Pitcher, syrup, S. N. Kandibinder 955,170
Plane, E. A. Schade 955,556, 955,557
Plant carrier, E. E. Husted 955,164
Planter, corn, E. Snyder 955,707
Planter, potato, T. L. Good 955,395
Planters, dropping attachment for corn, C. Hunnicutt 955,462
Planting machine, potato, V. Paulitsch 955,193
Plastic compounds, manufacture of, S. Morimura 955,421
Plate lifter, A. Panasci 955,428
Pliers, J. H. Sullivan 955,370
Plow, J. W. Cain 955,759
Plow attachment, L. H. Ruch 955,210
Plow attachment, sulky, E. Boyer 955,496
Plow, disk, J. H. Martin 955,179
Plow, rotary, C. H. Van Nostrand 955,297
Plug, socket and attaching, J. E. Luther 955,465
Pneumatic device for cleaning irregular surfaces, A. E. Moorhead 955,467
Pocket article guard, S. Korf 955,596
Pocket for garments, M. Lewin 955,649
Post impregnating apparatus, Morin & Reed. 955,422
Potato cleaner and sprouter, A. F. Seligman 955,364
Powder box, M. F. Shea 955,480
Power transmission device, S. Lippert 955,816
Press. See Drawing press.
Printing press, continuous, B. von Philip 955,196
Printing press inking mechanism, M. A. Droitcour 955,833
Propeller, screw, R. Tjader 955,721
Propeller wheel, A. E. Seltzer 955,291
Propulsion of vessels, F. W. Schroeder 955,214
Pulp feed regulator, A. Schultz 955,558
Pulverizer, Forrester & Browne 955,497
Pump, air, D. F. Cornell 955,321
Pump, centrifugal, R. O. Jones 955,168
Pump motor, compressed air, D. R. Tripplehorn 955,296
Pump, rotary reversible, C. Lacour 955,464
Pumping apparatus, X. Caverno 955,580
Punch, P. R. Duchemin 955,775
Push button, D. R. Lovejoy 955,521
Puzzle, T. Peacock 955,194
Radiator, E. W. Winans 955,241
Radiator, steam, W. M. Whitlock 955,300
Rail fastener, W. H. Castle 955,761
Rail joint, E. D. Lapish 955,274
Rail joint, Biser & McCrae 955,750
Rail retainer, J. Bradley 955,315
Rails to ties, mechanism for securing, W. Weber 955,233
Railway crossing, McKee & Coursey 955,346
Railway crossing frog, C. E. Ennis 955,145
Railway, electric, Brown & Harris 955,733
Railway, inclined, A. F. & A. T. Smith 955,217
Railway joint chair or coupling, D. McGill. 955,533
Railway signal fusee, I. Niditch 955,671
Railway signaling system, L. F. Howard 955,402
Railway structure, Reinoehl & Weaver 955,284
Railway structures, rail connection for movable, W. A. King 955,809
Railway switch and crossing, overhead, H. H. Tunis 955,228
Railway tie, F. H. Miller 955,345, 955,419
Railway tie and clamp, A. M. Wagner 955,724
Rake. See Hay rake.
Razor blade stropping device, C. G. Ward 955,298
Razor stropping machine, Buchler & Wasserstrom 955,578
Reamer, S. G. Ryder 955,696
Recording device, C. L. Jaeger 955,167
Recording mechanism, C. E. W. Gardner 955,789
Refining engine, W. White 955,299
Refrigerating plants, ammonia purifier for, L. Wagner 955,726
Refrigeration, W. Cooper 955,582
Refrigerator, F. Lomax 955,174
Refrigerator, J. G. Barnet 955,574
Releasing device, C. Hunt 955,163
Revolving table, C. B. Reed 955,827
Ringing system for party lines, harmonic selective, H. D. Currier 955,253
Rock drill, J. S. Harlow 955,591
Roof, M. A. Jackson 955,165
Roofing bracket, T. B. Hillmon 955,159
Rotary explosive engine, C. M. Green 955,155
Rotary explosive engine, G. G. Schroeder 955,288
Rubber sole protector for boots and shoes, E. Fuller 955,509
Rule, folding, J. F. Borne 955,314
Rule gage, E. Stone 955,369
Ruling device, line, C. W. Holtz 955,161
Safe protective means, W. Weikel 955,234
Sand blast apparatus, G. F. Steedman 955,714
Sand blast machine, C. F. Motz .... 955,468 to 955,471
Sanding device, air, J. E. Scobee 955,363
Sandpaper holder, E. Bell 955,575
Sash lock, J. Esler 955,778
Saws, separating plate for board cutting, J. W. & G. B. Burns 955,379
Scale, truck, E. L. Gage 955,640
Screen plate holder, R. J. Welch 955,622
Screw-driver attachment, A. Loewenberg 955,529
Seal, car, S. F. Estell 955,638
Seat support, R. C. Stewart 955,220
Sectional die, MacFarland & Eaton 955,277
Securing washer, J. H. Holmes 955,160
Seed huller, cotton, W. E. Jones 955,463
Seed hulling machine, cotton, J. McFarlane. 955,532
Sewage distributer, A. Browning 955,754
Sewage purification system, C. Potts 955,683
Sewer cleaning apparatus, J. F. Kuhlman 955,812
Sewer mold, T. E. Clark, reissue 13,106
Sewing corded tucks, machine attachment for, B. S. Cramer 955,322
Sewing machine attachment, M. Saldin 955,439
Sewing machine attachment, J. W. Veatch. 955,619
Sewing machines, etc., reservoir for button, J. Perley 955,195
Shade roller, L. T. Bulley, reissue 13,103
Shaper guard, W. G. Stewart 955,482
Shaving cup, J. Patronaggio 955,679
Sheet folding mechanism, W. Spalckhaver 955,367
Sheet holder, loose, J. C. Dawson 955,325
Sheet metal can or box, F. Wattne 955,445
Ship elevator apparatus, E. L. Burwell 955,131
Ship elevator, cradle, and dock, E. L. Burwell 955,130
Ship lock, tubular inclined, P. Caminada 955,317
Ship's towing system, R. Koss 955,412
Shipping case, M. Shepard 955,705
Shipping package, H. N. Mann 955,525
Shoe cleaner, E. L. Dahlfues 955,769
Shoe, running, W. Lawlor 955,337
Shoe stretcher, E. G. Allen 955,449
Shutter fastener, E. L. Watrous 955,728
Side and back comb, F. C. Reighter 955,689
Sign, W. J. Bailey 955,745
Signal device, submarine, F. R. Schell 955,359
Signal system, automatic stop, C. L. Iungerich 955,408
Skid shoe placer, T. E. Hines 955,400
Skirt protector, I. M. Rawson 955,687
Sled for carrying logs, A. O. Lombard 955,601
Slot machine, fruit selling, J. H. Tatum 955,718
Smoke jack, W. R. Seigle 955,290
Snow on roads, machine for leveling and rolling, H. Grimes 955,590
Solder, means for fluxing and supplying, W. Kirkwood 955,172
Spark arrester, Dunlap & Simons 955,504
Spectacles, R. W. V. Minor 955,278
Speed indicator, Spratt & Shenton 955,709
Speed mechanism, variable, F. S. Rand 955,201
Speed transmission device, variable, F. A. Moore, Sr. 955,279
Spike puller, W. T. Wilmer 955,570
Sprayer, W. H. Ireland 955,405
Sprayer, H. Mikorey 955,418
Sprayer support, pendent, W. H. Maxwell 955,342
Spring wheel, W. R. Gardner 955,258
Spring wheel, F. P. Prendergast 955,545
Stacker and elevator, pneumatic, A. Rosenthal 955,358
Stacker, hay, R. B. Harris 955,204

Stamp, hand, A. S. McGreevy	955,669
Stanchion, cattle, E. M. Krause	955,811
Stapling machine, J. L. Firm	955,505
Steel, purifying, R. H. Bulley	955,378
Stencil cutting machine, W. H. Scott	955,216
Stoker, mechanical, W. G. Crosthwaite	955,388
Stool, folding, L. J. O'Brien	955,349
Stopper. See Bottle stopper.	
Store service apparatus, L. B. Bethards	955,629
Stove, E. B. Cabone	955,758
Stove oven, cooking, C. Myers	955,668
Stoves, oil burner attachment for, W. T. Cheistian	955,499
Stovepipe, W. W. Graham	955,153
Street indicator, E. C. Schwartz	955,215
Studding, metal, C. Horix	955,401
Stump extractor, E. A. Ableman	955,737
Substances of high resistance, manufacturing, A. Schiomann	955,360
Substation protector unit, W. Kaisling	955,806
Swing, indoor, J. W. Chlad	955,135
Swingletree and trace connection, W. A. Stinson	955,613
Switch operating mechanism, electromagnetic, G. W. Donnan	955,391
Switches, means for operating end cell, J. W. Achard	955,448
Switchbord construction, T. A. Hammond	955,263
Tablet arm chair, A. A. Lytle	955,523
Taboret bath, S. Montgomery	955,603
Tanks, water supply for flush, H. J. Geurink	955,457
Telegraph sounder, G. F. Oehmen	955,676
Telephone and protective alarm system, combined, Nolen & Shepherd	955,472
Telephone attachment, J. W. Nilsson	955,190
Telephone signal bell, H. L. Wuerffel	955,302
Telephone system, M. S. Conser	955,633
Telephone system, bridging, H. F. Joeckel	955,335
Telephone transmitter, G. N. Quinby, Jr.	955,685
Telephone transmitter, P. Stragiotti	955,716
Testing machine, J. V. Reynders	955,202
Testing machine, Carney & Gadd	955,250, 955,630
Tetrachlor-indigo and making same, P. Julius et al	955,410
Thermometer, resistance, E. F. Northrup et al	955,191
Threshing machine, W. J. Hawkins	955,511
Ticket dispenser, C. H. Crawford	955,385
Tie plate and rail anchor, combination, P. W. Moore	955,529
Tile drain protector, O. P. Holbrook	955,593
Tire, L. M. Nelson	955,188
Tire, antiskidding, J. Corwin	955,634
Tire armor, W. W. Jones	955,169
Tire armor, C. E. Titus	955,831
Toilet fittings, sanitary support for, L. D. Bayley	955,247
Tongs, casing, C. W. Stone	955,560
Torches, attachment for blow, O. Berns	955,313
Toy, J. W. Zimmerman	955,492
Toy, J. P. Reinhart	955,550
Toy, figured, W. J. Botts	955,376
Toy, figured, S. Olop	955,677
Toy, pyrotechnic, A. & C. Weinrich	955,486, 955,487
Track and bracket, tubular, A. Wagner	955,371
Traction wheel, Thompson & Wallace	955,295
Transit, solar, P. Ferber	955,392
Trap. See Vacuum trap.	
Trap, N. A. Boe	955,751
Tray and truck, portable, A. C. McNiven	955,187
Trigger guard, Westcott & Hirt	955,237
Trolley wheel replacer, J. W. Anderson	955,742
Trolley wire hanger, W. A. McCallum	955,185
Truck, portable, W. H. Harris	955,398
Truck, rigid, H. H. Tunis	955,226
Tubular fabric, woven, A. Petersen	955,541
Turbine, power, J. Knight	955,648
Type holder or clamp, O. M. Howard	955,802
Typewriters, sight-assisting attachment for, P. E. Taylor	955,224
Typewriting machine, W. J. Roche	955,207
Typewriting machine, J. Felber	955,327, 955,328
Typewriting machine, H. H. Steele	955,368
Typewriting machine, O. Woodward	955,489
Umbrella tip retainer, C. Dilli	955,255
Universal joint, A. H. Fetzer	955,256
Universal joint, flexible, Kingston & Berg	955,595
Urinal, D. B. Walsh	955,485
Vacuum cleaning apparatus, A. F. Krause	955,810
Vacuum pan, F. Tiemann	955,483
Vacuum trap, O. Winter	955,374
Valve, J. E. Hill	955,158
Valve, J. Levey	955,600
Valve for explosive engines, C. Denegre	955,390
Valve inserting machine, C. A. Hoefer	955,334
Vehicle body, S. R. Bailey	955,494
Vehicle, motor, Messier & Bollstrom	955,602
Vehicle propelling means, motor, J. R. Faber	955,146
Vehicle wheel, J. W. Salladay	955,440
Vehicles, pneumatic spring suspension for, G. A. Rhoads	955,692
Vehicles, removable storm cab for, W. A. Hunter	955,404
Vending machine, perfume, A. F. Vorce	955,723
Ventilating device for use in connection with windows, A. W. Martin	955,178
Vessel, marine, B. Settergren	955,703
Vessels, apparatus for raising sunken, B. P. Clark	955,763
Vessels, device for raising submarine, M. A. Laubeuf	955,414
Vise, adjustable, G. A. Gefvert	955,259
Vulcanizer, C. A. Shaler	955,479
Vulcanizer removable cover, A. Adamson	955,739
Wall covering, P. C. N. Pederson	955,429
Walls, apparatus for the construction of plastic, H. C. Babel	955,304
Warp handling apparatus, H. D. Colman	955,383
Washer. See Securing washer.	
Washing machine, Maxwell & Hymer	955,181
Washing machine drive gearing, F. Kostlan	955,413
Watches, stem winding and setting mechanism for, G. Kern	955,336
Water closet valve, G. W. Fleming	955,780
Water controlling device, E. P. Gaylord	955,150
Water elevator, J. L. Wray	955,301
Water meter, J. H. Connell	955,766
Water motor, H. T. Farnsworth	955,148
Water motor, G. W. Coffield	955,501
Water or other fluid heating apparatus, G. A. Fowler	955,393
Water wheel, W. E. Seelye	955,478
Water wheel governor, W. D. White	955,568
Water wheels, gate controlling mechanism for, W. W. White	955,569
Weed burning appliance, G. L. O'Neale	955,425
Weighing machines, electrical controlling mechanism for, H. Richardson	955,693
Well digging apparatus, M. Latta	955,813
Well drilling machine, W. C. Stevens	955,612
Wheel rim securing means, O. R. Schoenrock	955,213
Wheel support, vehicle, C. H. Givens	955,790
Whip lock, J. Erickson	955,588
Whip lock and rim fastener, L. L. Noakes	955,535
Whip socket lock, J. R. Schwears	955,701
Wind motor, A. W. Bailey	955,305
Winding machines, stopping mechanism for yarn, H. C. Miller	955,657
Windmill, A. T. Scott	955,289
Windmill, A. M. Cox	955,768
Window lock, R. R. Reynolds	955,476
Windows tight against the ingress and egress of air, device for making, H. Higgin	955,157
Wire chain, I. A. Brown	955,129
Wire cutter, A. B. Schofield	955,287
Wire, treating rods for, Remmen & Sborigi	955,552
Wood, preserving, W. B. Chisholm	955,762
Wood shaping machines, safety device for, J. M. Jones	955,408
Wrench, I. H. Flory	955,781
Wringer base for laundry tubs, P. J. Madden	955,341

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., Inc., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., Inc., 361 Broadway, New York.

NOW READY

THE ANNUAL SMALL HOUSE NUMBER *of* American Homes and Gardens

THE May Number of American Homes and Gardens is devoted to the small house, its building, its decoration, and its furnishing. This issue contains a vast amount of information for the prospective home-builder. Especial attention is given to the inexpensive and small house, which is the most numerously erected dwelling in America, and which is the type of house that at once excites the widest interest and offers the richest field for suggestive helpfulness.

Various departments conducted by specialists add greatly to the value of this number and the aim has been to bring out the charm of the simple beautiful things which contribute to domestic comfort and happiness, solely for the purpose of solving the problems that confront the house-owner but which cannot be explained without the assistance of a competent expert. It will tell him how to select a country site, how to place the house upon it, the style of architecture in which the house should be designed, how the various rooms of the house should be planned, the material of which it may be built, the kind of plumbing fixtures to be used, the choice of hangings for the walls, doors and windows, appropriate furniture for the various rooms of the house, and how to lay out the grounds about the house as well as to the planting of them. Beside these departments, the magazine contains a host of articles that must inevitably stimulate the desire for home improvement.

MODERN HOUSES FROM THE ATLANTIC TO THE PACIFIC.—This is an article by Francis Durando Nichols, treating of the modern house as seen in the various parts of the country, and it is illustrated by photographic views of the exterior and interior of the houses, as well as the plans of five houses which represent the best type of modern house built at five different points.

IDEAS FOR COLONIAL FURNISHING.—Mary Livingston has prepared an interesting article which is illustrated by engravings, giving ideas for the furnishing of the various rooms of a colonial house, beginning with the hall and passing on through the drawing-room, the library, the dining-room and to the bedrooms.

HOME-BUILT GARDEN SEATS AND PERGOLAS.—A. Russell Bond tells in an illustrated article how it is possible for an amateur to build a pergola and a garden seat for a small garden. The article is illustrated by photographic views showing the pergola and the garden seat and also working drawings which may be used in carrying out the subject in active detail.

AMERICAN HOMES AND GARDENS GARDEN COMPETITION.—The fifth prize garden, won by Edward Payson, Esq., of Lexington, Mass., is illustrated by a photograph of the garden before it was developed, and also by one showing it a year later after it was developed; also a plan showing the position of the various beds of the garden.

AUTOMOBILING.—The automobile has become a necessity for the country house of today, and Roger B. Whitman tells in a practical way how it is possible for a man to have and maintain a modern low-priced motor car. The article is illustrated, showing automobiles costing from $485 to $1,000.

THE OUT-OF-DOOR LIVING ROOM.—The out-of-door living-room becomes a very important feature of the modern house at this season of the year, for the reason that there is no part of the house which should receive greater consideration than that of the living porch. Mr. John A. Gade has prepared an article treating upon this timely subject, which is illustrated, and which shows the various ways in which a porch may be furnished and inclosed with screens in summer and glass in winter.

SOME CALIFORNIA BUNGALOWS.—The California bungalow is always interesting, and Helen Lukens Gaut has prepared an article on this subject accompanied by illustrations of eighteen bungalows, costing from $150 upward. The bungalow is always interesting to those who want to live out of town during the summer months, and this article tells one how it is possible to obtain a bungalow at so low a cost as $150.

POTTERY MAKING FOR THE AMATEUR.—Everyone is interested in pottery making, especially the kind of pottery making which can be done by the amateur. Mabel Tuke Priestman presents in a beautifully illustrated article views that show some of the most beautifully made pottery in America.

THE SMALL KITCHEN OF TO DAY.—There is no part of a house which receives so little attention and yet requires so much, as that of the kitchen. Mr. Robert Spencer, Jr., has prepared an interesting article on its planning and equipment, which is well illustrated with numerous plans showing its proper relation with the other rooms of the house. All good housekeepers realize the importance of this subject, and no one is better qualified to give such information than Mr. Spencer, who has made a special study of the kitchen and its dependencies.

THE DEVELOPMENT OF THE ARTS AND CRAFT HOUSE.—Furnishing the arts and crafts house is a subject which is very well presented by Edith Haviland. Miss Haviland takes one through the house, and shows the proper furniture and treatment for the various rooms.

DECORATIONS AND FURNISHINGS FOR THE HOME.—Alice M. Kellogg presents her third paper, which is devoted to wall papers and curtains. This article is illustrated with photographic views showing the combination of wall papers and curtains of the same design and pattern, for the use at windows and also for the spreads to be used upon the beds and the couch of the sleeping-room.

THE USE OF CEMENT IN THE BUILDING OF THE SUBURBAN HOUSE AND GARAGE.—Mr. Robert W. Gardner, the well-known architect, who has made a special study of the use of cement, has prepared a very excellent article on the subject, which is profusely illustrated with many fine engravings, showing the various uses that can be made of cement in the building of the suburban house and garage.

GARDEN NOTES, BY CHARLES DOWNING LAY.—Charles Downing Lay describes in his department how to lay out and plant a lawn, the kind of trees and shrubs to avoid in planting, and a vast amount of other information that will be helpful to those who desire to improve the grounds about their home.

PLANNING THE SMALL GARDEN.—The garden is a frame for the house picture, and success in its treatment means that each tree and shrub should be properly placed as well as properly grown. Loring Underwood, the well-known author, tells, in a very pleasing way, how it is possible to obtain this garden frame. The article is illustrated with drawings showing how the garden was planned and photographic views showing how it has been developed.

MUNN & COMPANY, Inc., Publishers, 361 Broadway, New York, N. Y.